

Retrospective Panel Discussion

Moderator: RADM Robert C. Austin, USN (Ret)
Panel: CAPT Frank A. Andrews, USN (Ret)
RADM Guy H.B. Shaffer, USN (Ret)
RADM Virgil L. Hill, Jr., USN (Ret)
RADM (Sel) Charles L. Munns, USN



Left to right: ADM Bruce DeMars, CAPT Frank Andrews, RADM Guy Shaffer, RADM Robert Austin, RADM Virgil Hill, RADM (Sel) Charles Munns

Rear Admiral Robert C. Austin, USN (Ret)

Rear Admiral Austin was born in Cleveland, Ohio on September 5, 1931. After graduation from Maury High School at Norfolk, Virginia in 1948, he enlisted in the U.S. Navy. He obtained a competitive fleet appointment to the Naval Academy and was commissioned in June 1954. He served on USS NOA (DD 841) until he entered Submarine School in 1957.

His first submarine assignment was on USS THORNBAC (SS 418). In 1960, he enrolled in a weapons systems curricula at the Naval Postgraduate School and graduated with a Master of Science degree in Physics in 1963. After serving as Executive Officer of USS GRAMPUS (SS 523), he entered Nuclear Power Training and later served as navigator on USS TRITON (SSN 586) and as Executive Officer of USS JOHN ADAMS (SSBN 620). He was the Prospective Commanding Officer during construction and then commanded USS FINBACK (SSN 670) from 1968 to 1972.

He next headed the Advanced Tactical Training Division and was the Prospective Commanding Officer Instructor for the Commander of the Submarine Force, U.S. Atlantic Fleet.

Rear Admiral Austin then commanded Submarine Development Squadron TWELVE from 1974 to 1976. He commanded Naval Submarine School for the next two years. He returned to the staff of the Commander Submarine Force and served as Deputy for Operations and Plans and as Chief of Staff. He was selected for flag rank in January 1980. In July 1980, Rear Admiral Austin was assigned to the Joint Staff as Deputy Commissioner, U.S. Component of the U.S.U.S.S.R. Standing Consultative Commission and as Director for International Negotiations on the Plans and Policy Directorate (J5). From 1982 to 1986, Admiral Austin served as the chief of Naval Technical Training. He then returned to the Naval Postgraduate School where he served as Superintendent until he completed his active duty in 1989.

Rear Admiral Austin's decorations include the Defense Superior Service Medal, the Legion of Medal with four gold stars, the Meritorious Service Medal, and others.

Since completion of active duty, he has headed Austin Associates, Inc., and has been involved in training, education, research, and development with various panels and organizations.

Rear Admiral Austin and his wife, Joyce, now reside in Alexandria, Virginia. They have four children: Susan Ebdon of Shelton, Connecticut; Jim of Ledyard, Connecticut; Rob of Gales Ferry, Connecticut; and Cecelia Noorzoy of Monterey, California. They have ten grandchildren.

Captain Frank A. Andrews, USN (Ret)

Captain Frank A. Andrew, USN graduated from the Naval Academy 19 December 1941 in the Class of 1942. He was on the destroyer USS DUNCAN (DD 485) in the Pacific one year and USS SHUBRICK (DD 639) in the Atlantic one year. In winter 1944 he was transferred to Submarines where he continued on four war patrols on USS SENNET (SS 408)—the last one as Executive Officer into the Sea of Japan. Captain Andrews' honors include the WWII Awards Silver Star, Navy Marine Corps medal, and Bronze Star. In 1950 he received his Ph.D. in Physics from Yale University.

In 1951 Captain Andrews was ordered to SSK-1 as commissioning Commanding Officer. Then; in 1953, he went on to command the USS HARDER (SS 568). He became the Submarine Project officer at David Taylor Model Basin in 1954. In mid-1955 he was the PCO Instructor on SubPac Staff and continued onto Com Sub Div 72 in Pearl Harbor in 1957. After his assignment to Science Department U.S. Naval Academy from 1958 to 1962 Captain Andrews was ordered, in 1962, to be Commander Submarine Development Group Two in New London. During this time he was at sea commander of THRESHER Search.

After retiring from active duty in 1964, Captain Andrews joined the Engineering Faculty at Catholic University in Washington DC, with his principal activities including teaching and research in the graduate program of sonar and underwater acoustics. He was also a part-time consultant to General Physics Corporation, Columbia, Maryland. Captain Andrews became Vice President for Military Systems in 1981. Significant projects during his time with General Physics were the Mk 48 torpedo analysis and on board training. In 1988 he fully retired.

Captain Andrews and his wife live in Annapolis, Maryland. They have 12 children and 20 grandchildren. Three of his children graduated from the Naval Academy, classes of '81, '84, and '88. Of the other 9—one operates his own business, one teaches art in a Silver Spring High School, one is a missionary priest in Puerto Rico, one is a Professor of Deaf Education at Lamar University in Texas, one is a prosecutor in the Anne Arundel County Court system, one was a Social Worker for seven years at the University of Virginia Hospital but now works for the VISA bank MBNA, (this latter Andrews was a double gold medal winner in the 1984 Olympics as a member of the US women's swim team), one is the onsite computer maintenance person for a civilian contractor at Fort Bragg, and two work in private industry.

None of the three USNA grads stayed on active duty. One opted to become a wife and mother and now has 7 of her own children, one went into banking and one is a pediatrician at Children's Hospital in Philadelphia. All 12 graduated from college; several with advanced degrees. Captain Andrews notes that no one sends money home as is customary, he understands, in China.

Rear Admiral Guy H.B. Shaffer, USN (Ret)

Rear Admiral Guy H.B. Shaffer, USN graduated from the U.S. Naval Academy in 1951. He was selected to be a member of the first class to attend Navy Nuclear Power School. Following his time as a member of the commissioning crew of USS SKATE and USS SCORPION, Rear Admiral Shaffer went on to manage the development of the first SSBN Engineering Training Facility at Submarine School New London.

After completing his assignment as Executive Officer of USS THEODORE ROOSEVELT, Rear Admiral Shaffer was selected to precommissioning detail and first Commanding Officer of USS GREENLING. He became the Operations Officer at Submarine Development Group Two and subsequently Chief of Staff Officer. Following his assignments as 688 Program Coordinator in OPNAV and Director, Mid-70's Submarine Study, he returned to Submarine Development Group Two as Commanding Officer.

Rear Admiral Shaffer's next assignment was Deputy Director, Navy Strategic Systems Project Office. He then served five years as Director, Navy Command Control and Communications Projects (NavElex). Significant activities during this time included, initiation of JTIDS Development, introduction of OSIS, and ASWOC, introduction and validation of Over-the-Horizon Targeting (OTH) and the Outlaw Shark concept and unsuccessful efforts to gain Navy acceptance of TFCC. He then served as Director of Operations for the Defense Nuclear Agency.

Upon his retirement from the Navy in 1981, Rear Admiral Shaffer joined RES, Inc., an operations analysis consulting firm located in the Washington Area. From 1983 to 1987, he held several positions in the Government Communication Company Division of RCA including Director, Strategic Planning; Director, Signals Intercept Product Group; Director, Command and Control Product Group; and Director, USAF Mobile Missile C3 System Proposal Team. In 1987, he joined Martin Marietta, Aero and Naval System Division as Director for Research and Development. While at Martin Marietta, Rear Admiral Shaffer also served as Director, Systems Engineering and Director of Engineering.

Since retiring from Martin Marietta in 1992, Rear Admiral Shaffer has been a consultant to the Government (Department of Energy), industry (Martin Marietta, Aero & Naval System), and emerging technology firms on a variety of topics.

Rear Admiral Shaffer is a member of the Naval Submarine League, Defense Preparedness Association, Armed Forces Communications and Electronics Association, Navy League, Naval Institute, and National Defense Industrial Association.

Rear Admiral Virgil L. Hill, Jr., USN (Ret)

Rear Admiral Virgil L. Hill, Jr., USN became the seventh head of Valley Forge Military Academy and College on September 1, 1993.

Rear Admiral Hill attended the U.S. Naval Academy in Annapolis, Maryland, where he graduated with distinction in June 1961. Upon graduation, he was selected to serve in the Navy nuclear power training program. During his career, he served in nuclear powered attack and ballistic missile submarines in both the Atlantic and Pacific fleets.

Following four years in command of the nuclear-powered attack submarine USS HAMMERHEAD, Rear Admiral Hill was transferred to the Office of Naval Intelligence in Washington, D.C., as Director of Special Projects. Follow-on assignments included Commander, Submarine Development Squadron TWELVE in New London, CT; Director, Attack Submarine Program in the Pentagon; and Commander, Submarine Group FIVE in San Diego, CA.

Rear Admiral Hill was selected in 1988 to become the 53rd Superintendent of the U.S. Naval Academy. During his three-year tenure there, he supervised a major restructuring of the academic curriculum to increase the emphasis on mathematics, science, and engineering; installed a campus-wide state-of-the-art computer network; and successfully managed a first-ever \$23 million capital campaign to build Alumni Hall.

Rear Admiral Hill is active in national, state, and local associations and organizations. He is a former President of the Association of Military Colleges and Schools of the United States, a Director of USO of Philadelphia, Inc., a Director of the Association of Independent Colleges and Universities of Pennsylvania, member of the Public Relations Commission of the National Association of Independent Colleges and Universities, a member of the Military Task Force for United States Senator Rick Santorum, a Director of the Greater Main Line Branch of the American Red Cross, and a member of the Board of Directors of the Union League of Philadelphia.

Rear Admiral Hill and his wife, Kim, were married in 1964 and have two children. Their son Scott resides in Bermuda, and their daughter Kelly lives in New York City.

Rear Admiral (sel) Charles L. Munns, USN

Rear Admiral (sel) Munns assumed his current duty as Deputy Chief of Staff for C4I, Resources, Requirements, and Assessments, Commander in Chief, U.S. Pacific Fleet on 1 April 1998 and has been recently selected for promotion to Rear Admiral. As N6N8 he acts as Chief Financial Officer and Chief Information Officer for CINCPACFLT.

Rear Admiral (sel) Munns began his naval career at the U.S. Naval Academy, graduating with distinction in 1973 with a Bachelor of Science Degree, majoring in Physics. Early tours have included billets as Division Officer, USS SEADRAGON (SSN-584) from November 1974 to May 1978; Instructor, NROTC Unit University of Colorado from August 1978 to December 1980; Engineer, USS ETHAN ALLEN (SSBN-608) from August 1981 to March 1983; Navigator, USS NEW YORK CITY (SSN-684) from May 1983 to October 1984; Executive Officer, USS FLORIDA (SSBN-728) (B) from January 1985 to January 1987; and Executive Assistant to the Deputy Chief of Staff, CINCPACFLT from February 1987 to March 1989.

Rear Admiral (sel) Munns' first command assignment was as Commanding Officer of the USS RICHARD B. RUSSELL (SSN-687) from April 1990 to October 1992. During his command the ship was awarded a Presidential Unit Citation, two Navy Unit Commendations, and three consecutive Battle "E" Awards.

Following this tour, Rear Admiral (sel) Munns completed a Pentagon tour from November 1992 to July 1994 with assignments on the OPNAV Staff working for the Deputy Chief of Naval Operations for Plans, Policy and Operations (N3/N5), first in the Strategic Concepts Branch (N513), then as the Branch Head Nuclear Affairs and International Negotiations Branch (N514), and lastly for the Strategic and Policy Divisions (N51).

Rear Admiral (sel) Munns was then assigned to Major Command as Commander, Submarine Squadron TWELVE from July 1994 to August 1995 and was responsible for the operations, maintenance, and training of eight nuclear submarines and for tactical development for the Submarine Force. In September 1995, he was selected by the Chief of Naval Operations as a fellow on the CNO's Strategic Studies Group. His nine-month tasking was to create innovative operational concepts for Naval Operations in 2025 and beyond. From this post at the Naval War College he was detailed to serve from July 1996 to May 1998 as Chief of Staff, Commander Submarine Force U.S. Pacific Fleet.

Rear Admiral (sel) Munns has additional education which include a Masters of Science in Computer Science from the University of Colorado in December 1980 and attendance at MIT's Seminar XXI on Foreign Politics and International Relations from September 1993 to June 1994.

His personal decorations include the Distinguished Service Medal (Two Awards), Legion of Merit (Three Awards), Meritorious Service Medal (Two Awards), Navy Commendation Medal (Three Awards), and the Navy Achievement Medal.

Rear Admiral (sel) Munns and his wife, Kristin, have two children. Amanda is a graduate of Texas A&M University, and Jeff is a high school student.

Retrospective Panel Discussion

DEMARS: RADM Bob Austin will be the ringleader for our panel. He is admirably prepared having served as an enlisted electronics technician, received a fleet appointment to the Naval Academy, has a master's degree in physics from the Naval Postgraduate School. Bob commanded FINBACK on Cold War special operations, the Development Squadron, Submarine School, and was the Chief of Naval Technical Training and the Superintendent of the Naval Postgraduate School.

CAPT Frank Andrews will cover the 50's and the 60's. Frank graduated from the Naval Academy two weeks after Pearl Harbor, had a destroyer sunk out from under him in the second battle of Savo Island, finished World War II as a submarine XO at age 24. He has a doctorate in physics from Yale, he commanded K1, HARDER, was the PCO Instructor in SubPac, commanded Submarine Division SEVENTY-TWO, and Submarine Development Group TWO.

RADM Guy Shaffer will cover the 1970's. He graduated from the Naval Academy, commanded GREENLING on Cold War special operations, Submarine Development Group TWO and was Deputy Director of the Navy Special Projects Office, the pre-eminent missile group.

RADM Virgil Hill will cover the 1980's. He's a Naval Academy graduate, commanded HAMMERHEAD, conducted Cold War special operations, commanded Development Squadron TWELVE, Submarine Group FIVE, and served as Superintendent of the Naval Academy. He currently is head of Valley Forge Military Academy and College.

RADM Chuck Munns will cover the 1990's. He may get the prize for coming the longest distance. He'll have to share that with ADM Mies; I'm sure they'll sort out how they split that. Chuck is a Naval Academy graduate, has a master's degree in computer science from the University of Colorado, commanded RICHARD B. RUSSELL on Cold War special operations and the Development Squadron, and is currently the chief financial officer and chief information officer for the Pacific Fleet.

AUSTIN: Thank you, Bruce, for introducing the panel. It's a great pleasure to be here. I've had the great fortune of having Bob Fountain relieve me on two occasions, one as a PCO instructor and one as the DEVRON commander. It's hard to follow in his wake. I want to compliment him on his excellent review of the DEVRON's history. With Bob's talk in mind, we will launch into a roundtable discussion of the details and an examination of some of the challenges of the times. Without further ado, let me ask Frank Andrews to start off with a quick summary of the key challenges that the 40's and the 50's presented and our response to them.

ANDREWS: First I wish to tell Bob Fountain that his talk was outstanding. The fact that my name was mentioned did not affect my judgment. Bob has covered the 50s and 60s very well. I can give a few additional statements that will be of interest.

First, in WWII, U.S. submarines sank submarines but they were on the surface. Overall U.S. forces sank 120 Japanese submarines. Of these 23 were by U.S. submarines—all by daytime periscope approach or by radar approach at night.

The BATFISH, Jake Fife commanding, sank three submarines in three days. When the 46's and 47's came along, no one questioned the submarine's ability to sink surfaced submarines. It was the snorkel sub and the battery sub that were the targets of concern. Sinking these, was the problem

Senior submariners in OPNAV and then Roy Benson in New London interacting with the scientists, started on the solution. The key thing was to be passive sonar and the bearings only approach. The major goal at the beginning, when I showed up in '51, was to increase detection range.

I was PCO and then CO of the USS K1. We had the first U.S. built array sonar. The BQR-4. We had no idea what the performance of the array would be. We had no knowledge of convergence zone. The target of the day in 1951 was a cavitating snorkel submarine, making eight knots. There was no question about acoustic advantage when you were a battery submarine.

In 1951, the detection ranges that were being obtained by the JT sonar against a snorkeling cavitating sub were typically 8,000 yards to 10,000 yards, and this was after a major work-up to reduce own self-noise by rigging for "ultra-quiet", by hovering, by turning off all kinds of equipment.

On our first major K1 at sea exercise, we operated off of Bermuda. The major event was picking up the HALFBEAK at what was finally reconstructed to be 30 miles. Amazing! It was a Convergence Zone detection—and we didn't even know what the word was.

In addition to the bow array sonar, we had a number of fire control tools. By this time (1951) the time-bearing plot was already well developed. The speed strip and geo-plot were also all being used as was the tracking solution on the TDC. Ekelund ranging was not known at all. The point I'm making is that in the early fifties everybody was starting from scratch. There were a lot of ideas but it took a long time to develop them and make them all work together.

Finally, I want to make a remark about scientific exercise design and analysis. I got credit for the selling of the TAG (Tactical Analysis Group), and that's true, I sold it. But, the idea really came from Art Jerbert, who was my chief of staff. I also want to give praise to the Brits who were involved with this. Robin King, R.N. and Jerbert—those two fellows actually created the idea, but they put it out in a book about that thick. It was very difficult to sell it to OPNAV and the people who were going to fund it. So my role finally was to get it down to where we could talk about it, and everybody would understand it.

That concludes my specifics. Increasing detection range against submarines was the problem for 20 years. It wasn't until later on that acoustic advantage started to become a problem. In the 50s and 60s, no problem with acoustic advantage; it was always to increase detection range and find accurate solutions for target range, course and speed.

AUSTIN: Guy, the Tactical Analysis Group had been born and was off and running in the period that you are covering. New SSNs had been added by classes of 637s and 688s, and a myriad of new equipment had been introduced. How sharp was the cutting-edge, and what are your thoughts on your era?

SHAFFER: As Frank mentioned, all of us have had a lot of our thoughts pre-empted by our principal speaker. I'm going to have to echo the same thoughts in some regard as Bob did. The 70's were really the golden age in a lot of respects for the Development Group because it was a period of consolidation, building on what had gone before. We had a basic standard how to construct and analyze an exercise. We had a basic understanding of the acoustic equation and what was going on in the water, and we had available a tremendous technical explosion in computers, in new sonars, new weaponry, combined with the continued enjoyment of a single well-defined mission. This was a period of time during which we were developing cruise missiles; we were developing all sorts of submarine techniques. While these things influenced and affected the work of the Submarine Development Group, it still remained focused on a commitment to meet a defined threat.

I sympathize with the DEVGROUП commander of today, who is being given the task of handling a myriad of challenges and is not being given the opportunity to examine them in the depth that is required. I would say that the benefit of being in the DEVGROUП in the 70's was having a lot of new technology, new submarines, new weapons, and being able to continue to focus them on our traditional ASW role and to develop better and better ways to exploit the improved analysis skills that we were developing. For example, we built the SARF (Semi-Automated Reconstruction Facility) during that period of time. We codified the Naval Warfare Publications (NWP) series, thanks to Bob Austin here. We had good TAG officers. Most of the officers I had in the TAG were Operation Analysis graduates and had operations analysis experience. We had wonderful exchange officers from the Royal Navy. These men provided a tremendous benefit because the British have always had the ability to sit back and cold-bloodedly analyze the confusion everybody else was creating, and then say, "Have you thought of doing this?" And usually it worked.

We also had the ability to interact beneficially with other agencies. For example, I remember when I was Chief Staff Officer and Jack Fagan had the Group, that a lot of our time was spent in teaching Johns Hopkins how to do reconstruction analysis as they geared up to start examining the SSBN performance. Much of Johns Hopkins' credibility in SSBN security analysis came from the techniques that the DEVGROUП had developed and the way it analyzed and conducted exercises.

I had the opportunity at that time to interface with the Destroyer Development Group. Everything Bob Fountain said is absolutely true. The Destroyer Development Group had one ship. Its total focus was on trying gimmicks—new ways to launch lifeboats—all sorts of things, without any reconstruction facility. As time went on, it became obvious that the difference in what the destroyer development efforts were accomplishing and what the submarine development efforts were achieving was like night and day. This was principally because of the support that the Development Group got from higher authority.

So it was a wonderful period of time. Bob summarized a lot of it. There's nothing more that I can say except it was great to be there.

AUSTIN: Virg, by the 80's a great number of exercises had been analyzed and tactical concepts had been developed. How did it correlate with the real world?

HILL: I look at that time period as the best of times and the worst of times. It was the best of times because we had so much great data and history to build on. Our NWP series was

solid, well defined, and credible, unlike any other group of tactical guidance anywhere else in the Navy or maybe at the surface. Our ships were very capable, and they were performing well in special operations. I've always thought that one of the great strengths was our ability to take all of the data from special operations and analyze that which was relevant and then to verify our tactics or correct and change and make new tactics. Whenever we evaluated a new piece of equipment, we could evaluate it in a truly real world scenario. That way, we knew for that piece of equipment we were giving the very best possible set of operating guidelines. It was very short-term before it would actually be in the real world, and we could once again evaluate its effectiveness.

I think that the rigor and the discipline of the nuclear power program that was evident in the DEVRON was very strong and gave us, as I said, the best defense. It was during that time period that we started to feel the pull, though, as inevitably with the introduction of missiles we had to start looking at another role and figure out how to do that. As the Underwater Sound Lab brought us longer and thinner and longer and thinner and almost weekly longer and thinner wires, we found that our range was going further and further—further than we could deal with, further than we could really evaluate, and certainly further than any of our weapons systems could affect. The submarine satellite communications systems was making it possible now for ever-hungry and thirsty battle group commanders to demand more and more submarine time and submarine connectivity, and we were reluctantly drawn into that role, which again somewhat, in Bob's terms, tended to water down our effort a little bit.

Of course, the hardest thing in my mind that we faced in that time was the advent of the digital fire control system. We had all grown up with a physical love for something like the TDC, something that we could stand right up to and get our hands on, impress ourselves with our knowledge of the sine tables, and solve a problem. All of a sudden, you've got this machine that you turn one knob and you get Star Wars. It was a very frustrating time for the older generation to try to figure out how to use those digital fire control systems. It obviously was the way of the future, obviously it was the computing power that we needed to use these longer ranges, but it was very, very frustrating. Fortunately, as is always the case, the young people came through for us. These young men, who had grown up with Atari and Pac Man and whatever, sat down in front of those consoles and understood, probably better than most of us, just how to whip them into shape and make them work. They found the way to make it work, and we did emerge from that decade with a fully digital capacity that was, I think then and now, fully explored and used properly. But those were some hard times.

AUSTIN: Chuck, the 90's saw the end of the Cold War and with it there were extensive changes that were unexpected—from the open ocean to the littoral and beyond. How did this impact on the DEVRON?

MUNNS: The 90's are probably best understood, from my perspective anyway, in the context of what was happening in the world at this point, so let me talk about four "bookends," if you will. We started the 90's with the demise of the Soviet Union, with two collisions that had taken place: us versus the Russians, publicly talked about. We hope to end the 90's with the successful war against the year 2000 problem, which represents all the technology and digital age, which have come about. We started the 90's Goldwater-Nichols, joint duty, littoral warfare, and these sort of structural changes which have come about. We are now ending with the balanced budget, domestic pressures, and a lot of emphasis on dollars and reduced force structure. So there are four threads through

there—our world, technology, our structure, and our dollars—which raise a question of relevance.

That's probably the single point of the 90's: how do we answer that question of relevance? There's a sharp dichotomy there; we've never been more relevant as you look forward into the future as to what's going to be required in the sense of the littoral and being forward and being non-provocative and being less vulnerable and a small force. At the same point, our relevance has never been more in question. The DEVRON has tried to help answer that question and has focused on Congress, OSD and Navy to affect our budget, as well as on our junior officers to affect retention, because if we don't get the budget right, if we don't retain our people, we won't be here to talk about it in the 00's and 10's of the 21st century.

DEVRON has helped answer that question of relevance. It's helped us decide what things we ought to be doing and, more importantly, make sure we're doing those things right. They've been the keepers of our intellectual capital, the examiners of our processes, and certainly some strong influence on what our equipment has looked like.

AUSTIN: I have a compendium of a few questions, and then we'll ask the floor if they would like to join in the questioning. Frank, I'd like to go back to you and in the acoustical nature of things, how was sound really understood in terms of technical definition? What were the source levels, what were the background levels, and how did we come about discovering the real acoustical nature of that ocean that we came to exploit so thoroughly?

ANDREWS: By 1949, the Underwater Sound Lab people had introduced both the weapons systems effectiveness equation and the sonar equation to the DEVGROUP. A classmate of mine, Charlie Bishop, and Capt. Barney Sieglaff, Commodore in 1949, made a series of presentations throughout the submarine Navy to teach the sonar equation.

Even by 1962 it was very difficult to talk "sonar equation" to the senior people. They could follow the stock market, but they didn't want to hear dBs and the sonar equation.

But back to the question. Starting in 1949, the sonar equation was used to analyze the components of importance in long range passive sonar detection. No concern about measuring L_s , which is the dB level of the noise that the target radiates. Reason—the main target of interest was the very noisy snorkeling submarine.

But L_n , which is own ship's self-noise—that was a problem. It was due to sea state as well as own ship machinery and flow noise. Over-the-side sound measurements in port were made to identify noisy machinery. Sea state noise likewise could be measured. So the DEVGROUP had a good understanding of these numbers. As for the propagation loss— N_w —DEVGROUP had to depend upon the scientists to measure this. I think by 1964 the three paths for sound propagation; direct, bottom bounce and CZ, were understood by all DEVGROUP analysts and by the DEVGROUP boats. The prediction problem in a given OPAREA was often the lack of measurements in the specific area.

Of interest is that CZ propagation was discovered and investigated as early as 1951 by Columbia Labs. Shallow water propagation numbers continued to be poor because of so much reflection by both the sea surface and bottom.

The cycle of at sea exercises, data measurement and data analysis was executed in the DEVGROUP from the very beginning. A unique action instituted by Benson was the constant interaction with scientists with the at sea data in hand.

It was a wonderful combo of people who were mathematical analysts or underwater acousticians in the labs, the universities, with the operators in the DEVGROUP. The DEVGROUP people were the receivers of this good civilian technical knowledge, but they—the DEVGROUP—went to sea and tested it and came back and said “Hey, look,” etc.—a marvelous interaction.

AUSTIN: I am pleased to see that portions of Admiral Benson’s oral history are included in the Proceedings. I recommend you read it. It provides an excellent account of the founding of the DEVGROUP and insight on how we began to understand the role of acoustics in the submarine versus submarine mission.

Frank, you also had a major undertaking with the loss of the THRESHER. Would you mind telling us about that?

ANDREWS: I’ve heard the wise person says that failure is often God’s way of telling you that you’re doing something wrong. Certainly that was true in the case of the THRESHER design. Thresher’s first skipper, Dean Axene, came to me after I relieved DEVGROUP and said he had a problem with the thousands of feet of salt water piping inside the hull, and all at ambient sea pressure. And that was the problem, which caused the loss of THRESHER. It was of course later rectified by the SUBSAFE program for all submarines.

The other thing that came out of the THRESHER loss was the eventual commissioning of SUBDEVGROUP ONE. Most of you here in this audience know far more than I about the eventual efforts and successes of SUBDEVGROUP ONE.

The THRESHER search required deep ocean, sea floor search using sonar, magnetometers and cameras. The THRESHER debris was, in fact, exactly located and photographed by a group from the Naval Research Lab led by Buck Buchanan.

Buck and his people trailed a tow cable 12,000 feet long off the stern of their host ship USNS MIZAR. On the end was a box like frame called a fish. On the fish were mounted several sonars, a camera and a magnetometer. The design and use of this early technique was developed extensively for operations by SUBDEVGROUP ONE, and was used to search the ocean floor for various things, like lost missiles and so on.

Thus the THRESHER loss—a failure as it was—led into some important new directions. A very tragic thing, of course— 29 people lost—but that’s what happens often in our world when you take on new challenges.

SUBDEVGROUP ONE is certainly a good new direction arising out of the search for the THRESHER. So was the SUBSAFE program.

AUSTIN: I was amazed at the tremendous amount of paper and people required to reconstruct the simplest of exercises in the early days, and certainly a major step forward was getting the Semi-Automated Reconstruction Facility. Guy was responsible for that. It seems sort of quaint today. I think it speaks well for the kind of collaborations that we had, and I’d like you to tell us a little bit about how you got that out of OP-95.

SHAFFER: After I left the DEVGROUP as Chief Staff Officer, I went to OP-02 and suddenly found myself as director of a study to define the mid-70's submarine, which ultimately evolved—more years later than I care to admit—into some of the submarines we have today. It became obvious that if we were going to sell a product in Washington, we had to be able to sell it on numerical performance numbers. This was the heyday of the MacNamarra whiz kids. In order to get numbers and get them rapidly and to get them consistently, it became obvious that the manual reconstruction, while it was thorough and detailed and provided the numbers, frequently provided them later than we needed them in the brouhaha of fighting for dollars in Washington. Fortunately after 13 months on that study (which was more than enough), I left Len Stoehr to pick up the pieces and finish the study and I came back to the DEVGROUP as Commodore. Frankly, it was based upon the lessons I had learned in Washington, plus some very friendly faces in OP-95 that I had interfaced with (we were fortunate in those days to have submarine admirals in OP-95 as well as in OP-02), it was possible to sell the idea that if we really wanted to move forward and get the weapons and submarines we needed, we needed to improve the ability of the DEVGROUP to turn out results. I was delighted to learn yesterday that finally we're going beyond the SARF now and moving ahead because anything that's been around for 20 plus years is probably due to be replaced with something better, and I'm glad that the new Commodore is looking to that realization.

AUSTIN: Virgil, most of our exercises were reconstructed using data packages from two or more participants. There were occasions when our submarine performance had to be analyzed using only one data package. Can you tell us a little bit about what was involved in the latter?

HILL: In the first place, it had to be carefully done because we were handling very sensitive information, but I think that was one of our strengths—our ability at the DEVRON to handle that information and to do the reconstruction. It was laborious, it was careful, it went through so many different levels of credibility check. We had a very special relationship with the intelligence community—with Rich Haver and his group sitting down there—so that we knew we could glean every little piece of information external to whatever it was we were analyzing to see how that reflected. When you put it all together, by having as much data as possible externally, I think it was a credible reconstruction. I think it was extremely valuable reconstruction. It vetted; in most cases, our tactics or certainly gave us impetus to change those tactics that needed to be changed or equipment operating guidelines. I always felt that we could justify everything we did and wrote and said in our NWP's, both on our exercises and from our real world operations. I think that was critical to our credibility in Washington.

AUSTIN: Chuck, did the DEVRON have a critical role in the analysis of over-the-horizon targeting, and to what extent were we responsive to that requirement?

MUNNS: Certainly during this period we saw the advent of the TOMAHAWK and missiles that were shooting well beyond the horizon. There had been some successes and some hard spots there, and DEVRON was right in the middle of that analysis. The analysis also extended beyond DEVRON in this case into many communities. DEVRON had a seat at that table, to look at the personnel side, the tactics side, the doctrine side, and to ask questions about the technical side to make sure that the missiles would shoot when we pushed the button. And that effort is ongoing. An example of that success is MIAMI—during her last deployment she has done a wonderful job shooting missiles in two theaters.

- HILL: Can I add to that? In the early 80's when I was at DEVRON, we loved the MK-48, and we focused so much of our work on the MK-48. We literally had to have our arms twisted to work on HARPOON and TOMAHAWK tactics and targeting because it just wasn't our focus. Our focus was ASW. The MK-48 was our sweet baby, and that's where we put our focus. And appropriately, we literally had to be forced into bringing the HARPOON and the TOMAHAWK work into the main line of the Development Squadron. I know after I left, Denny Jones, Tom Ryan, and those that came along were doing a great job in bringing it in, but DEVRON was somewhat reluctant to bring those into the mainline effort of all of the important weapons. We were just so in love with the MK-48. It was a difficult transition for us.
- AUSTIN: We've bantered around a few questions amongst ourselves, and we have a few more, but I'd like to open it up to members on the floor. If anybody would like to rise and ask the panel a question, please do so at this time.
- AUDIENCE: Vice Adm. Joe Williams (retired) commented on some sub versus sub exercise in Pearl when he was a skipper of one of the SSK conversions in SubDiv 72. His subject was the testing of new sonars—the BQR-2 versus the BQR-4.
- ANDREWS: Well, Joe, I was privileged to hear Captain Dave Gove (present Commodore of the DEVRON 12) talk to a group of submarine active duty and retired flag officers yesterday afternoon. And it's the first time in my life that I've been in the presence of so many stars, where there were so many bright guys. These guys talked computers and net centric and all the things that are going on, like I never heard in my day. Usually Joe Grenfell (ComSubLant in 1962) would come in, give you a pat on the back, and say nice things and shove off. Then the workers would get to the details. The meeting yesterday was different, so something's changing!
- AUDIENCE: [inaudible] Remark about SUBAIR cooperation.
- ANDREWS: In 1952, SSK mobility was sad. A fine set of tactics were put together for using VP and SSKs as an interactive pair on a barrier. The tactic was given the name SUBAIR. In fact, by 1959 or so the war plans of SUBLANT were to put a SUBAIR barrier up by Labrador to catch any Soviet submarines coming down. When the Cuban crisis occurred, that's where the boats were deployed. Kind of crazy when you think about it because that's not the way to operate in a forward area where there's a potentiality of strike against own air. But that was a big deal because of low SSK mobility. Now with nuclear power that would change dramatically, of course.
- AUDIENCE: What direction and support did you receive from the Type Commanders?
- AUSTIN: My fellow DEVGROUP commanders and I have discussed the very strong support and broad direction we were given by the Type Commanders. Our mission was to develop by careful reconstruction and analysis most effective submarine tactics and equipment employment. SUBLANT assigned us submarines with the latest equipment configurations. A remarkable aspect of the DEVGROUP was our collaborations with outside groups which were encouraging and extremely productive. These collaborations ranged from those with laboratories such as naval weapons at Newport, sound lab at New London, electronics at San Diego, research at Washington, to university laboratories such as Johns Hopkins, Penn State, and MIT, to special contractor research, analysis and support groups. If there was a good idea and it had potential for improved

effectiveness, we were trying to put it to sea and measure its performance and contribution. We kept the Force Commanders informed. We received a strong “go ahead” as long as it had potential to contribute to the effectiveness of the Submarine Force.

AUDIENCE: A couple of you mentioned the benefits of the tactical development synergism between Electric Boat [the DEVRON or Sound Lab]. What about the synergism of DEVRON with the SUBSCHOOL? Does that still exist?

AUSTIN: I will take that question inasmuch as I had the privilege to command the DEVGROU and the SUBSCHOOL back-to-back.

When I was a young officer I recall reading DEVGROU reports in the general reading file. The reports described measured at-sea performance of passive ranging and outlined how to get best results. While attending the PCO course, the PCO Instructor had the DEVGROU brief us on their program and its results. What clearly stood out was the methodically measured performance of 594 class submarine capability. When I was in command of FINBACK, our first major exercise following commissioning was a open-ocean, torpedo firing, cleverly structured free play DEVGROU SUBASWEX. I learned more about fighting with and against a modern submarine in this two week exercise than I had learned during my professional lifetime to that point. In my follow on tour as the PCO Instructor, we re-structured the at-sea tactics and torpedo firing exercises to closely follow DEVGROU format. In reviewing these personal experiences, I found they had a major impact on learning the war fighting capability with which I had been entrusted. In outlining the structure of the NWP's, Sub School was tasked to be the proof reader of each manual, with a careful review such that each would serve as an authoritative text for instruction within the school. The collaboration of both organizations is essential in order to feedback up-to-date lessons learned to our beginning strength—the young officers and enlisted joining the force. It was clear in the past and seems equally clear now that a dynamic synergism between the DEVRON and SUBSHOOL must be a cornerstone if we are to stay at the frontier of submarine warfare.

MUNNS: I'll just comment on one partnership in the late 90's, and that's interactive computer based training. SubGroup TWO is focusing it, but as we're putting together these CDs, compact disks, on which resides the training we want to get to the ships, there's certainly a big tactical part of that. So DEVRON sits in that partnership, and, of course, the schoolhouse people are there from the “how do we get the training across” point, too.

SHAFFER: It's like when Jim Patton was heading up the TAG, we used to use the SUBSCHOOL facilities quite liberally. In the late evenings, we would gather teams of instructors and some students and actually walk through and practice some of the more complex evolutions that we were trying to put together and plan for our exercises. By matching attack teacher against attack teacher, we were able to do that and probably saved ourselves a lot of miserable hours at sea by being able to work it out using those facilities and those bright young fellows who were in there teaching tactics in the attack center. So it's always been a good synergy.

ANDREWS: Bob, I've always looked at those NWP series as an outstanding contribution because they represent corporate knowledge and corporate memory. I always like to think of them as the textbooks that you buy in the university that are used by the seniors and the

first-year graduate students. That doesn't mean you have to solve a problem exactly the way it says it there, but at least you have some information to get started with and then you can go on and solve the problem. So; therefore, what the Submarine School really should be teaching are the NWP's.

The PCO instructor on the other hand, ought to be interacting very closely with the latest thinking. The PCOs and the PCO Instructor should already know the NWP's. The PCO instructor then becomes the Professor in graduate school who is working with the PCOs as graduate students; who are on the line to be future skippers.

SHAFFER: In thinking about what Bob Fountain said and since I like to read history ... something that I think ought to be constantly in the minds of the Development Squadron, Development Group, and their masters is that events seldom develop the way we predict them. The Fleet Boat, and the reason it was called the Fleet Boat, was the concept in the 30's of how the submarine would be used as an advance scouting force for the fleet. This was to be the Submarine Force role. By the time the Japanese were through on December 7, there wasn't a fleet and the Submarine Force undertook a role that they had not envisioned in the 30's and did it very, very well. In the late 40's and early 50's, I doubt if anybody considered that special operations was going to be an important event for some 30 plus years. But it turned out that way, and it had a large measure of influence on how the Cold War ended.

The point I'm making is events don't materialize the way you think, but the basic fundamental knowledge to do your job does. The importance over the years of the Development Group is that it has focused largely on developing the techniques and the hardware to do the submarine's job in the way that the submarine can do it in a myriad of different situations. I think that it's something we need to keep in mind about the Development Group as we go forward. That's basically in my mind what the Development Group Squadron's role is—is to teach basic submarining and to bring basic submarining hardware along in a way that it is useful in a wide range of areas.

AUSTIN: Any other questions from the floor?

AUDIENCE: RADM Tom Ryan USN (Ret), former DEVRON Commander asked: With the massive amount of information coming into a submarine at sea in a Net Centric form of future warfare, when do people have a chance to sleep? [AUSTIN: How does a submarine with its small manning keep up with the torrent of communications while operating with a Battle Group?]

ANDREWS: I was on destroyers for the first two years of World War II, and I want to tell you, our Captain was worrying about that Admiral over there on the carrier or the cruiser all the time. We were going night and day. Rest was a big problem. We were at morning general quarters, evening general quarters, etc., etc. I went to submarines, the skipper would go in the forward area all by himself; he was running the whole thing; he controlled relaxation time. We'd make an attack, and we'd haul out for a period of time so the Captain could rest. And we'd go back in with everyone rested. So the point you're bringing out is an excellent point because once you start operating with these guys that are running around on the ocean doing their thing and you're part of it, it's going to be tough to get the rest period that you're talking about. It's just going to have to be worked out and insisted upon I suppose. Don't forget—the guys over on those surface ships over there aren't getting any rest either. That's a problem, too.

- SHAFFER: I think that's a great question. I'd love to ask somebody who's doing it right now because it certainly worried me at the time.
- MUNNS: I would just say that it certainly makes work hard, and I think one of the answers to understanding the Battle Group is living as part of the group, making them understand the submarine and what it brings—its capabilities and its limitations and vice versa. One of the next deployments in the Pacific, we will have squadron commanders riding as part of the Battle Group staff—it won't be just one, they're going to rotate through two months at a time. They'll be out there on the staff to help that communication. And that's already taken place. We have had submariners already as Battle Group Chiefs of Staff in assigned billets over the last four or five years as well. So that's part of the answer.
- AUSTIN: I got a royal teaching from the Royal Navy on communications brevity from VADM Henry Leach, Flag Officer 1st Flotilla. He commanded the Battle Force during Ocean Safari 75 and insisted on absolute brevity in communications being transmitted. I had the marvelous opportunity to serve as his SEC (submarine element coordinator) operating three SSNs in direct support.
- AUDIENCE: VADM Joe Williams said: I told Henry that he was not to keep those submarine at periscope depth communicating and you were out there to ensure that they were used effectively to protect his force.
- AUSTIN: I thought that was just the way the Royal Navy operated. Let us get to summarizing up our panel here. There were a couple of questions we were asked to address, and I'll just pass it down the line and run it up. Frank, what was the greatest lesson learned and what do you think was the greatest challenge that was faced in your era?
- ANDREWS: Don't give up! And tell the truth.
- AUSTIN: That was the biggest challenge ?
- ANDREWS: That's it! Because there were lots of failures, there were lots of problems, and there were lots of people that thought that the DEVGROUPE ought to be something different. So you have your program, you keep at it. Tell the truth, and keep at it.
- AUSTIN: Guy?
- SHAFFER: The DEVGROUPE in the 70's was the time when the effect and benefits of being able to focus on narrowband. I think for a number of years thereafter that was the lesson learned. It was passed on and on, and it had a lot of great value. The greatest frustration, which is another way of phrasing the other half, is that we suffered from one of the first efforts to transfer the submarines out of the Development Group and to make the Submarine Development Group a shore based tactical organization rather than an operating squadron. The question has been raised over the years on other occasions, and I'd just like to comment that the Development Group would not be the same without having those boats. Two reasons: one, the feedback from the skippers is essential to the people sitting ashore. This feedback which goes on continuously not just at a hot washup is essential to the DEVRON's success. Equally important I say, having been in the R&D world after I left the Navy and having seen both sides of the equation, let me tell you that the skipper who gets a new piece of equipment, if he's in the Development

Group, that equipment gets conscious, deliberate, and well-executed attention. If it's just put on another submarine somewhere, it's usually treated as an interference, an interruption to their well-ordered life. Given the choice of putting equipment for evaluation on a DEVGROUP submarine or any other submarine in the Fleet, I would take the DEVGROUP submarines every time. That fitness report has a great beneficial effect when the skipper is told what he needs to look at.

AUSTIN: Virg?

HILL: Well, as I said, I think the biggest challenge we faced was the digital world. We had all grown up and learned and lived in an analog world and to suddenly be thrust into thinking digital, to trusting digital, and using digital was a true, true challenge for us. And in some cases, we are still dealing with it—we went from the few small desktop calculators, as Admiral Williams called them when he distributed them, to the enormously complex, fully integrated computer systems to operate virtually everything. It was hard for us to learn to trust them, sometimes with good reason, but in that process, I also learned a very good lesson. I learned that youth has a far better capacity to adapt than perhaps we give them credit for and certainly than do we older ones. I was always a little bit surprised and certainly rewarded to see how quickly the younger people adapted and changed and brought that digital thinking into their way of life, into their way of war fighting and into their way of professionalism. So it all had to do with digital in that time.

AUSTIN: Chuck, we'll take departure with you. You're the active duty representative, and you face the seas and you have your fingers on the purse strings of the Fleet. What are the sea changes that are out there, as you see them? What's driving tomorrow?

MUNNS: I'd offer up two challenges as we move into the 21st century, both of which the DEVRON is going to have to be involved with. The first is just dealing with the complexity of our system, our world, our people, our culture ... we're living in a day now where the Battle Groups get 3000 e-mails a day. We're working in littorals where submarines can hear hundreds of miles. It takes 28 people to shoot a torpedo, all stuck in the control room. Somehow or other through that complexity ... we need to get to some simplicity. The problems that we're dealing with, certainly at the Fleet can't be solved by any one organization. It's only in the teaming of many organizations which can solve those problems, so DEVRON ends up in the role of bringing that team together, to help solve many of these issues. In the sensor area, in the beginning we worried about bearings. It was a single element. Today with the sonar it's not just bearing, but it's depression angle, it's frequency, it's bandwidth, it's periodicity of the signal, it's intensity of the signal, as well as the rate of change of each of those parameters, and so it's very complicated. The DEVRON's challenge again there is to make some simplicity out of that. Certainly multi-sensors, multi-missions, we've talked through all of that. So that's one challenge—somehow making complexity simpler.

The second is the network—as we move into the 21st century, it's my view the network is going to change everything. It's going to change our culture, it's going to change the way we communicate, it's going to change the way we organize. Our expectations of privacy and visibility, even our expectation of how do we provide value to this society that we're a part—the DEVRON will need to deal with that. They will need to do as much in information management as they have in equipment management in the past. Maybe a way of thinking about it is as a CO of a ship in the past, we spent lots of time

with the navigation party and looking at navigation planning for the course they were about to take. In the future, that commander and leadership group of the ship will spend just as much time worrying about where they're going in information space—trying to define the information that they need, the set of databases that they'll use to solve those questions, the queries that they're going to ask in those databases, the search parameters that they're going to use to search the web, the doctrine statements that they'll insert adaptively into the algorithms. And even adaptive organizations—it probably won't be one structured organization that we use for all purposes; it will change. So this sense of the network and how it's going to change us to our core will be a big challenge for what the DEVRON's got to do and deal with over the next decade.

ANDREWS: I have a question for Chuck, if I may. A year ago I was out in Pearl visiting my daughter, and I was privileged to go to the briefing by RADM Jerry Ellis, COMSUBPAC. I was impressed at that time with his approach to the diversity of development efforts because, he said, we don't have enough money to have two or three of any new system. So when something new, some new piece of equipment or idea comes out, I'll give it to this boat and this squadron or this boat and this squadron, etc. Guy Shaffer just got through talking about the necessity to focus the effort of submarine vs. submarine or whatever you're going to do in the DEVGROUP. Now how do you put those two views together? You do have to investigate a lot of things because you're in the mode of not yet defining really the major role for submarines. You're not quite sure what submarines are going to do—you've got missiles, mines, and so on. And here's the DEVGROUP—do they focus on something or what happens? How do you put them together?

MUNNS: I think it's a multi-faceted world, and they're going to have to try to do all of it, not necessarily all by themselves. There's lots of other pockets out there that they can use, so the DEVGROUP is the one that integrates all that, brings it together, brings those other experiences and then gets it into the—I was going to say publications—but gets it into our intellectual capital. There won't be documents. There will be some other electronic medium.

ANDREWS: The early days of the DEVGROUP were easy in one sense—the target was defined.

MUNNS: Right.

ANDREWS: Now we don't know what the target is.

MUNNS: It's diffuse.

ANDREWS: On the other hand, there were people talking about troop carriers and oilers and radar pickets—and pretty soon those all died down. What I'm saying is that as time goes on, I think what's going to happen is there's going to be two or three major roles evolve. It depends upon what the other guy is doing. Who is this guy—Chinese or whoever? And when you begin to see him, then I would imagine the DEVGROUP will start to focus on that—because you can't do everything!

AUSTIN: I want to thank my fellow panelists. It's been a privilege to address you this morning.