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NORMAN R. AUGUSTINE

PCAST

Transcript of an Interview
Conducted by

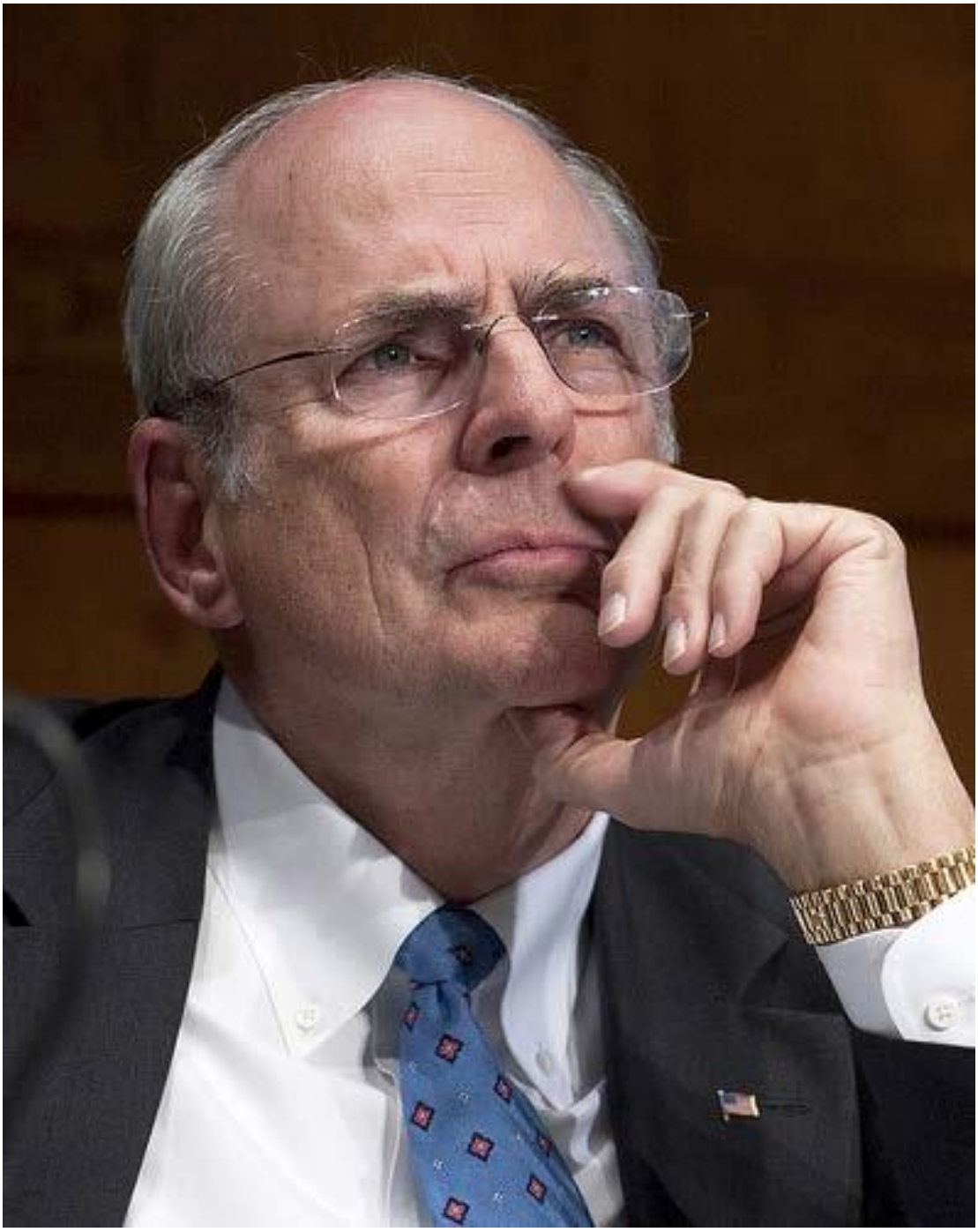
David J. Caruso, Kenneth M. Evans, and Kirstin R. W. Matthews

via Zoom

on

22 September and 15 October 2020

(With Subsequent Corrections and Additions)



Norman R. Augustine

ACKNOWLEDGMENT

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NORMAN R. AUGUSTINE

1935	Born in Denver, Colorado, on 27 July

Education

1957	BSE, Princeton, Aeronautical Engineering
1959	MSE, Princeton University, Aeronautical Engineering

Professional Experience

	Douglas Aircraft Company
1959-1961	Research Engineer
1961-1963	Program Manager
1963-1965	Chief Engineer
	Office of the Secretary of Defense
1965-1970	Assistant Director of Defense Research and Engineering
	LTV Missiles and Space Company
1970-1973	Vice President of Advanced Programs and Marketing
	Office of the Secretary of the Army
1973-1975	Assistant Secretary of the Army (R&D)
1975-1977	Under Secretary of the Army
1976	Acting Secretary of the Army
	Martin Marietta Corporation
1977-1982	Vice President of Technical Operations
1982-1985	President, Denver Aerospace
1985-1986	President, Information Systems Group
1987-1995	CEO
1988-1995	Chairman
	Defense Science Board
1981-1983	Chairman
	Advisory Committee on the Future of the US Space Program (Augustine Committee)
1990	Chairman

	American Red Cross
1992-2001	Chairman and Principal Officer
	President's Council of Advisors on Science and Technology (William J. Clinton)
1994-2001	Member
	Boy Scouts of America
1994-1996	President
	Lockheed Martin Corporation
1995-1997	President, Chairman and CEO
	Princeton University
1997-1999	Lecturer with the Rank of Professor
	National Academy of Engineering
1980	Chairman
	Association of the U.S. Army
1982	President and Chairman
	In-Q-Tel
1999	Founder
	President's Council of Advisors on Science and Technology (George W. Bush)
2001-2009	Member
	Review of United States Human Space Flight Plans Committee
2009	Chairman
	U.S. Antarctic Program Blue Ribbon Panel
2011	Chairman
	United States Energy Security Council
2011	Member
	Secretary of Energy Advisory Board, Department of Energy
2019-present	Member

Honors

1952	Eagle Scout
1983	Member, National Academy of Engineering

1991	National Space Club Goddard Award
1992	Fellow, American Academy of Arts and Sciences
1992	Rotary National Award for Space Achievement National Space Trophy
1994	Silver Buffalo Award
1994	Electronic Industries Association Medal of Honor
1995	Golden Plate Award of the American Academy of Achievement
1997	The Washingtonian's Business Leader of the Year
1997	National Medal of Technology and Innovation
1997	The NASA Distinguished Public Service Medal
2001	IEEE-HKN Eta Kappa Nu Eminent Member
2002	Space Foundation's General James E. Hill Lifetime Space Achievement Award
2004	USO's Freedom's Finest Award
2006	Public Welfare Medal, National Academy of Sciences
2006	The Harold W. McGraw Hill, Jr. Prize in Education
2006	BENS [Business Executives for National Security] Eisenhower Award
2007	Bower Award for Business Leadership from the Franklin Institute
2008	NAA Wright Brothers Memorial Trophy
2009	IRI Medal from the Industrial Research Institute
2009	The American Chemical Society Public Service Award
2009	B. Kenneth West Lifetime Achievement Award
2010	NAS Award in Aeronautical Engineering from the National Academy of Sciences
2011	Drexel University Engineering Leader of the Year
2011	The Wings Club Distinguished Achievement Award
2012	Character Education Partnership's American Patriot of Character Award
2012	Montgomery County Business Hall of Fame
2012	Industry Week Manufacturing Hall of Fame
2014	Smithsonian Air & Space Museum, Lifetime Achievement Trophy
2014	Arthur C. Clarke Lifetime Achievement Award
2015	Advisory Board, Journal of Science Policy & Governance
2015	American Astronautical Society Space Flight Award
2015	Tech Council of Maryland Lifetime Achievement Award
2015	International Von Karman Wings Award
2016	Air Force Distinguished Public Service Award
2016	Maryland International Business Leaders Award
2016	Lockheed Martin Corp. Organizational Leadership Development Program Award
2016	National Institutes of Health Director's Award
2016	National Defense University Foundation Lifetime Achievement Award
2016	Sigma Xi Honorary Scientific Research Inaugural Gold Key Award
2016	American Red Cross National Capital Region Lifetime Service Award
	35 Honorary Degrees

ABSTRACT

Norman R. Augustine was born on July 27, 1935, in Denver, Colorado. An only child, he grew up just about on the prairie and loved spending time in the nearby mountains. His father fought in World War I, and Augustine remembers growing up during World War II—hearing about the attack on Pearl Harbor, participating in air raid drills, and celebrating the end of the war with VJ Day. Augustine's family valued education, and he enjoyed his high school classes, especially math and physics. After some targeted encouragement from Justin W. Brierly, the school's self-appointed college guidance counselor, Augustine applied to Princeton University and was accepted. He originally planned to major in geological engineering but switched to aeronautical engineering after a drunken student he was trying to save from falling off a train told him aeronautical engineering was the future. Princeton focused on fundamentals and theory in aeronautical engineering, and because there were only nine aeronautical engineering students in the class, Augustine said it was like "private tutoring." As part of his curriculum, he participated in flight testing and worked as a research assistant one year. Upon recommendation of the faculty, Augustine decided to pursue a master's degree and stayed at Princeton because he had a nice fellowship. He wrote his graduate thesis on the dynamics and aerodynamics of a vectored slipstream aircraft with a double-slotted flap and built his own models, having learned woodworking from his grandfather. Upon graduation, Augustine took a position at Douglas Aircraft where he started first in a research group and then moved to development projects, working primarily on the Nike Zeus. He talks about transitioning to management, a missile launch that went wrong, and the early types of computers, including humans who computed.

After seven years of working at Douglas, the company's new CEO decided to cut pay, so Augustine looked for other opportunities and accepted a position in the Office of the Director of Defense Research and Engineering (DDR&E) to learn more about what it took to write a good proposal—although he actually did not spend any time evaluating proposals in his new role. He talks about meeting and marrying his wife, adjusting to life in Washington, DC, and working in the Office of the DDR&E. He also mentions what it was like to work at the Pentagon during the Vietnam War and discusses spending a brief time in Vietnam as a civilian. After five years of government work, Augustine was ready to return to industry and accepted a position at LTV Corporation in Dallas, Texas. He discusses transitioning to life in Texas and working in management and compares working in government and working in industry. After three years at LTV, Augustine accepted a position back at the Pentagon as Assistant Secretary of the Army for Research and Development. He talks about the confirmation hearing, life working in the Pentagon, and receiving promotions. After Gerald R. Ford's term was up, however, he planned to return again to industry and accepted a job at Martin Marietta. Augustine discusses Bendix's hostile takeover attempt of Martin Marietta, becoming CEO, and the Challenger disaster and the fall of the Berlin Wall. After the collapse of the Union of Soviet Socialist Republics, the government called defense companies together for a "Last Supper" meeting to discuss the need for defense companies to merge and consolidate, which led to Martin Marietta transitioning to Lockheed Martin.

Augustine describes his work on government committees, including being appointed by George H. W. Bush to oversee a committee focused on the space program, his involvement with the President's Science Advisory Committee (PSAC) and the President's Council of Advisors on Science and Technology (PCAST), the goals and structure of PCAST, and the role science

and technology should play in government. He concludes by comparing the Defense Science Board and PCAST, talking about buying the first share of Lockheed Martin stock, and noting his gratitude to civil servants.

INTERVIEWER

David J. Caruso earned a BA in the history of science, medicine, and technology from Johns Hopkins University in 2001 and a PhD in science and technology studies from Cornell University in 2008. Caruso is the director of the Center for Oral History at the Science History Institute, president of Oral History in the Mid-Atlantic Region, and editor for the Oral History Review. In addition to overseeing all oral history research at the Science History Institute, he also holds an annual training institute that focuses on conducting interviews with scientists and engineers, he consults on various oral history projects, like at the San Diego Technology Archives, and is adjunct faculty at the University of Pennsylvania, teaching courses on the history of military medicine and technology and on oral history. His current research interests are the discipline formation of biomedical science in 20th-century America and the organizational structures that have contributed to such formation.

Kenneth M. Evans is a scholar in science and technology policy at Rice University's Baker Institute for Public Policy. He received his BS in physics from the University of Virginia and his MS and PhD in applied physics from Rice University. His research focuses on the history and organization of the U.S. federal science advisory and policymaking system, with an emphasis on the role of the White House Office of Science and Technology Policy.

Kirstin R. W. Matthews is a fellow in science and technology policy at Rice University's Baker Institute for Public Policy and a lecturer in the Department of BioSciences at Rice University. Matthews manages the activities of the Baker Institute Science and Technology Policy Program, and the Center for Health and Biosciences' Biomedical Research Program. Her research focuses on ethical and policy issues at the intersection between traditional biomedical research and public policy. Specifically, she focuses on regulation and ethical issues associated with emerging biotechnology, including vaccines, stem cells and genomic medicine. Matthews also leads a project to review scientific advice in and to the federal government, including the White House Office of Science and Technology Policy and the President's Council of Advisors on Science and Technology. Matthews has a BA in biochemistry from The University of Texas at Austin and a PhD in molecular biology from The University of Texas Health Science Center at Houston.

ABOUT THIS TRANSCRIPT

This interview was conducted as part of the project, "The President's Scientists" (NSF SMA SBE #1854055). The goal of the project is to improve and expand existing knowledge of the role of the President's Council of Advisors on Science and Technology (PCAST), and its impact on U.S. federal policy. This project examines the working nature and policy impact of the council by compiling and analyzing presidential archives and university collections of former presidential science advisors (developing a digital archive of this material); and conducting oral history interviews of select former PCAST members to determine their perspectives on PCAST, as well as their personal histories before and after their tenure on the council.

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INTERVIEWERS: **David J. Caruso**
Kenneth M. Evans
Kirstin Matthews

LOCATION: **via Zoom**

DATE: **22 September 2020**

CARUSO: [. . .] Great. Perfect. So I'm going to do just a little bit of an introduction, and we'll start getting into some of the questions. Today is September—I've lost track of the date—September 22, 2020. This is an oral history interview with Norm [Norman R.] Augustine. We are conducting this virtually via Zoom.

I'm David [J.] Caruso at the Science History Institute. Also participating are Kirstin [R. W.] Matthews and Kenny [Kenneth M.] Evans from Rice University. This is part of the [President's] Council of Advisors on Science and Technology [PCAST] project. So thank you again for agreeing to speak with us.

And as I mentioned, I am going to start at the very beginning. So I know you were born in 1935. I'm not going to ask you about the birthing experience. I don't think you probably remember that. But you did . . . you were born at a time—the Great Depression—when America was trying to get back on its feet. So I'd like to hear a little bit about what it was like for you in those early years, maybe if you could tell me something about your parents. What did your parents do? Did you have siblings? Something along those lines to get us started.

AUGUSTINE: Sure, I was born in Denver, Colorado, July 27, 1935, [at] St. Luke's Hospital. I had an older sister who [had] died by the time I was born, and unfortunately, in those days, [such] tragedies were not that uncommon. I went to public schools. My parents were wonderful people, loving people. I was very fortunate [in my] choice of parents. Given that my sister passed on, I was raised basically as an only child, and I know [that] psychologists [and] psychiatrists say that only-children tend to be interested in "things" because there aren't a lot of people around them, and [indeed] I was interested in "things." I liked to take [blocks] apart and so on. [They] tend to become scientists and engineers, which I did not start out to be, but I will say I had an interest in those things. My recollection of those years . . . well, I should say, my family—my parents—I was the first one of my family to go to college; I was the second one to go to high school. My mother graduated from high school, and my dad worked [. . .] on the wholesale fruit and vegetable market in Denver for most of his adult life. Later in [her] life, my mother, when I was in junior high school, [. . .] took a job that proved to be a disaster for me because she took a job as the attendance clerk at the [. . .] school I was attending! She recognized all the parents' handwriting, so this was a big problem. Putting that aside, the times

were difficult—as you said, or is it not on this part of the tape?—but it was coming off the heels of the Depression and people tended to be relatively conservative, to be thankful they had a job and to look out for each other. Shortly after the Depression wound down, [. . .] World War II started. [. . .] I was six years old when the war started. I remember the day very well—even now—when it happened and how I heard about it. It ended when I was around ten, and I remember that day very well, too, [. . .] I don't know how much more detail you want to . . .

CARUSO: Sure. I'll ask some questions. So you grew up in Denver. Were your parents from Denver as <**T: 05 min**> well? Did they . . . were they born and raised there?

AUGUSTINE: My mother was born in Denver in 1893, at which time, life expectancy was forty-seven in this country. She lived to be 105. My dad was born in Illinois in 1894 and lived to be ninety-six, and he served in World War I. My family—I've traced the family history back to [. . .] 1574—in Ellmendingen, Germany, and I've tracked them throughout [their] history. The times in [my youth] were tough, particularly with a war going on. . . you didn't have [very much gasoline] and certain kinds of food you didn't have, and you collected scrap metal and you collected newspapers and anything that might help the war effort. Another thing I particularly remember was in the windows of houses down the street—the older boys were all [. . .] disappearing, they were going somewhere—and there were the stars in the window. The silver stars or the gold stars for [. . .] people serving [or having died] in the military from that home.

I lived on the very east side of Denver, just about on the prairie. [There were] about six more blocks—let's see—and then there was prairie, and out on the prairie a ways was Fitzsimmons Army Hospital, which of course was [. . .] jammed at that time. And every Sunday afternoon, my father would [. . .] take me and we would [get in] his old Terraplane car, drive to Fitzsimmons and pick up three or four soldiers who were in good enough shape to get out for [. . .] Sunday afternoon, and they would come to our house and have dinner. They had different soldiers every week, and the thing that I remember about them and learned from them was how positive they were. I mean, these were folks with real problems, and they were very positive [and] they were mostly eager to get back with their old units and fight in the war. Anyway, I went to high school in Denver, and [. . .] in 1953 that I graduated from high school the week that the Korean War ended. Otherwise I would have been drafted for sure. And so I've had a lot of cases [like] that in my life where the fork of the road presented itself and through blind good fortune, I "picked," I guess, what turned out to be a reasonable fork. [. . .]

CARUSO: So, when you were growing . . . Sorry, go ahead.

AUGUSTINE: I'm sorry.

CARUSO: No, go ahead. I didn't mean to interrupt.

AUGUSTINE: I was going to talk a little bit about my interests and how I wound up in engineering. Would that be of . . .

CARUSO: Yeah, I just have a few other questions about your childhood. So did your father talk about his experiences in the war?

AUGUSTINE: Very little. He . . . let's see [. . .] he went to training at an Army training camp in New Mexico. I can't think of the name of it, and then shipped [out] through Fort Dix, New Jersey to Liverpool, [England]. He said he walked or rode in boxcars across most of France and went up into the front lines in Germany with his unit, which was the Fourth Infantry Division. The night that they pulled into the front lines, the cannon [. . .] became silent, and the people on the front lines had no idea what had happened. It turned out that the armistice was signed. It was November 11, [1918], and so my dad was very fortunate to never . . . Then he served in the army of occupation in Germany, and ironically where he served was just a few miles from where my family grew up in the sixteenth century, [although he didn't know that]. Just as a kind of a trivial but interesting aside, I visited **<T: 10 min>** that little village [. . .] and there's a [. . .] big bronze plaque in honor of the names of the soldiers from that little village in Germany who had fought [and died] in World War I, obviously on the German side. There were names of two people who had the same first and last name—except in the German form—as my father and my uncle, who had both fought on the US side. Small world, crazy world.

CARUSO: Yeah, so when you were growing up, you mentioned that your mother graduated high school, your father had not. Was there a strong emphasis on education for you when you were younger? Was that something that your parents wanted for you to excel at school and things like that? Was a general course they wanted you to pursue?

AUGUSTINE: I think typical of that generation—my parents' generation—education was deemed as extremely important—that you should certainly try to graduate from high school, and if [it] were possible [. . .]—it wasn't clear it was [. . .] go to college. And the fact that they had not had a lot of education, they really appreciated the importance of education. There was never any doubt in my mind that studying in school was important, and I don't ever remember them hassling me to study or anything, but it was just . . . it was clear that was a foundation that you had to study and try to be a good student. I was blessed with going to very good public schools. I had good teachers and particularly had great math teachers, which certainly was important to me. [. . .] As I think about it, we didn't have many books around the house. Very few in fact. But I had a library card when I was little, and the library was a bicycle ride away. So I was always in and out of the library getting books—mostly fiction—and learned to read, loved to read, just as I do today. Don't have enough time today. [. . .] We didn't know a lot of people who had an education, so if you did know somebody who had been to college, that was [. . .] a big deal. Well, I guess that would be kind of it. It [. . .] didn't occur to me until many years after I was out of college—I'm an engineer—[. . .] that I don't think I'd ever met an engineer until I

was at Princeton [University]. But the people [. . .] I grew up with were wonderful people—hard working, decent, honest folks; but not a lot of them had the opportunity to go to college [or even high school].

CARUSO: Were there other things that your parents introduced to you around the house? Was music an important component of their lives? Religion? You mentioned you were six blocks away from the prairie. Did you go on evening strolls and find animals roaming in the fields or anything like that? Like what else, if anything, was going on in the house when you were younger?

AUGUSTINE: Music was not . . . didn't play a role in my upbringing, really. I enjoyed music, but [. . .] we didn't have music in the house. We had an old Victrola, a record player—mechanical type—but I don't recall it ever being on. Reading was important; reading the newspaper was important. Art in the form of painting or anything like that wasn't something that was around. Outside the house, living in Colorado [. . .] was a blessing. I loved the outdoors. The mountains weren't that far away. I'm sure I spent at least a year of my life in a tent in Colorado. I worked at the Boy Scout camp as—what'd they call them?—a **<T: 15 min>** "member of the staff." Beautiful camp up about nine thousand feet in the Rockies and lot of outdoor experiences. Of course, you [saw] all the animals you see in the mountains, and I was interested in that, and I was interested in the trees, the various names for the flowers, and I think whatever I learned about leadership I gained [. . .] through either the Boy Scouts or through participating in athletics. I loved sports; I always had a ball in my hand. I wasn't great; I was good enough to be competitive and to play. But as it happens, in my adult life, [. . .] professional athletes [were very much] in my family. I wasn't in that league. But I could enjoy sports, and I really did learn so much from sports about leadership, about losing with grace, following the rules, treating others with respect, about hard work, and about how little [. . .] differences [in effort] make a big difference in outcomes. [In almost] every [lost] game, you [can] think of one thing if [done differently might have won, changed the outcome]. I very much learned a lot and loved sports—still do.

CARUSO: You mentioned Boy Scouts. Were you involved as a Cub Scout as well? Did you start that early in life?

AUGUSTINE: Yes, I was. I was in the Cub Scouts. I had a wonderful Den Mother who I used to visit until she passed on—Mrs. Esbenson—and she put up with six kids who [. . .] must have driven her crazy. They had a dalmatian. We used to put a Cub Scout shirt on the dalmatian at special meetings. It's interesting, too, that we were all from the same neighborhood with the same more or less kinds of backgrounds. And, I'm trying to think, of the six of us, one became [president of a bank], one became a dentist, one became a physician, one created [an] antique car business—and myself. All did well in life, all good people.

CARUSO: There's also a relatively close association between Boy Scouts and the Christian religion. Did religion play any part in your early life?

AUGUSTINE: Yes, I'm a Presbyterian and we went to church, I guess I would say occasionally. We were not steady attenders. Religion, I wouldn't say [. . .] played a big part in my life—[. . .] in my youth or in general—but it was always there, and you were supposed to live a life that was befitting your religion. But it was never a major factor one way or the other, I would say. [. . .]

CARUSO: Yeah, I mean, I'm curious about various aspects of individual's lives. So you know if anything does come up during the rest of the interview, please feel free to share that. So I have a general impression that . . . a general impression of what things were like for you when you were younger. You mentioned you also—I think you'd mentioned—you remembered where you were where or you remembered when the end of the World War II was announced, is that correct?

AUGUSTINE: And the beginning as well.

CARUSO: Yeah, so what do you remember from when the end of the war was announced when you were ten years old?

AUGUSTINE: Well, the end of . . . by that time, I was very aware that there was a war going on and what that meant. At least I had some idea of it. Each day on the front page of the Denver Post—our newspaper—there would be a map, and it would show where the battle lines were in Europe. When the battle lines moved to the right, that was good; when they moved to the left, that was bad. You watched <**T: 20 min**> each day [. . .] what was happening in the war. [. . .] One day, finally, it was announced—VJ Day—that the war was over. I remember my parents thought this would be a historic event that they wanted me to experience, so we took the streetcar—the old electric-driven streetcar—from the far east part of Denver [. . .] to downtown Denver. Denver was a city of about four hundred thousand people at that time—[a true] Western city.

And downtown, the place was jammed. There were people everywhere. There were people throwing confetti and pieces of newspaper, and I can remember that . . . Denver was a big military town—a lot of air bases and Army facilities—the soldiers [were] running up and kissing the girls on the street; the girls seemed to go along with it. And [. . .] one thing I still remember, people were climbing through the windows in the streetcars [. . .]. They'd climb in and climb out of the windows—younger people. The thing that struck me [was] that they

weren't paying to get on the streetcar. People were singing, and everybody was everybody's friend. It was just a great celebration.

Going back [three-and-a-half years] I guess it would have been—on the beginning of the war, my parents had taken me to an Italian restaurant on the edge of Denver—a place called Louisville—that we used to occasionally go [. . .] for Sunday lunch. We were having our lunch and all of a sudden, a guy pulled the door of the restaurant open and yelled, "The Japs bombed Pearl Harbor." I didn't know what was meant by "Jap," nor did I know what Pearl Harbor was. [. . .] He slammed the door and wound up running down the street with his Paul Revere-like message. The restaurant went silent. Then all of a sudden, there was this outburst of conversation. That was when I first learned about Pearl Harbor being bombed. Interestingly enough, I was at Pearl Harbor for the occasion of [the attack's] seventy-fifth anniversary. [It was a treat] to go to a restaurant; that was rare. We always had plenty of food—not expensive or fancy food—but plenty of it. My mom was a great cook. And basically, I had a very happy youth.

CARUSO: So just one other question about wartime. When the atomic bombs were dropped on Japan, did you as a child have any awareness that that happened or what atomic bombs were?

AUGUSTINE: Really, I did not. I knew it was a big bomb, and it had been dropped on two cities. [. . .] It's hard to put in context today—the national mental attitude. We'd been through Pearl Harbor and all the losses in Europe, battles going up the cliffs of Normandy, fighting [on] the islands in the Pacific, and kids going away [who] never came back. We had air raid drills in Denver, of all things; I'm not quite sure whoever would have got to Denver in those days, but we had a curtain over the bathroom window and a red light bulb. Every now and then, there'd be an air raid drill, and we'd—my mom and dad and I—would go in the bathroom, shut the door, pull down the curtain, and turn on the red light, and wait until the siren said it was okay to come out. There was a neighbor who was the neighborhood "enforcer" who would walk around looking for light leaking out. He wore a white helmet, I remember, and he was the most important person in the world out there braving the dangers of the streets of Denver in the middle of the war, [. . .] I don't think a bomber could have got within a thousand miles of us. But that was the way it was.

CARUSO: So just to switch back **<T: 25 min>** towards your education. Do you recall what classes you were most interested in or not interested in at all when you were in elementary school and middle school? Like were there some subjects that you prefer over others?

AUGUSTINE: Yes, you like the ones you do better in, so I liked math, I liked physics. I was not crazy about chemistry, although I sat next to the girl who became Miss America, and that was a good part about it. [laughter] I liked speech [class]. I think it came down to who was the teacher, who was a good teacher. For example, I was not fond of history. But subsequently,

today, I read every history book I can lay my hands on [and] I can find time [to read. There] was a course in sociology I took, which I didn't like because it was too intangible for me. [. . .] You pretty much had to take the courses you were told to take; you didn't have a lot of choice. The schools I went to were, as I mentioned, very good public schools. The high school I went to, my class in high school—the class of 1953—was larger than my class at Princeton. It was a huge high school, and that had ramifications because if you wanted to really excel, it was very difficult. For example, I used to fancy myself as a basketball player. [The] school [had so] many students [that I] discovered I was not [as good a] basketball player [as I had hoped]. A lot of things [were] like that. It was hard to really be first at anything because the school was so huge, and it was a very, very good school.

CARUSO: So when you 're going to high school ['50] to '53, those are clearly postwar years and I think maybe this is a little too early, but the US and started to make a big investment in science and engineering education, trying to make sure that we weren't going to be falling behind, compared to other nations. Were you seeing anything or can you recall anything specifically in your high school years that, you know, maybe there were some classes that teachers were able to, you know, go maybe a little bit off topic and address more contemporary interests—US interests—in terms of science and engineering? Were you maybe being taught by someone who had received a master's degree or a PhD in mathematics or physics or anything along those lines? Is there some . . . anything you recall from your high school experiences that would be along those lines?

AUGUSTINE: Every teacher that I can recall [basically had] a bachelor's degree, mostly in teaching. [Some were great, especially in math. Miss Mott, Mr. Charlesworth, the "terrifying" Mr. Marinoff, Miss Gleasner in speech.] And at the end of the [war years], I went away with the impression that we didn't win the war because of technology; we won it largely because of the production capability of the country. We just out-produced everybody else. And in more recent times, I've come to realize that—of course with the atomic bomb being a huge exception and radar and things like that—[. . .] I now know [. . .] we had a bigger lead in some technologies than we realized. Technology—with the exception of the atomic bomb—in our view hadn't played such a huge role in the war; it was mass production and well-trained troops that made the difference. [. . .] I should probably give a little perspective. People used to say to me, "You're good at math, so you should be an engineer." But I really didn't know what an engineer did, and **<30 min>** I had no intention of being an engineer. If you'd like, I'll give a quick description of how I wound up in that line. Is that relevant?

CARUSO: Yeah, I mean, I wanted . . . so one of my next questions was going to be when you're in high school, what were you thinking about what it is you wanted to do in the future? I'm also curious to know how you got to Princeton and why you chose Princeton? So if you want to talk about that now, great. I leave that up to you.

AUGUSTINE: Okay, I'll do that. I guess I didn't give a lot of thought to what I [eventually] wanted to be when I was in high school. I did know that I should try to get as much education as I could. [. . .] I don't think I had any particular interest in engineering or science, although I was decent at it. People would say, "You're good at math; you should be an engineer." I guess I, sort of, drew the connection, but I really had no particular interest in being an engineer. [I can] remember [one] conversation very vividly. My senior year in high school, beginning of the year, there was a teacher at our high school, his name was Justin W. Brierly, and he always had the W. Mr. Justin "W." Brierly! I had never had a class [with him], but he was known as being one very tough guy, and he also was, sort of, [the self-appointed college] guidance counselor at our high school. So one day I get a note that Mr. Justin W. Brierly wants to meet with [me] in his classroom immediately. [As was well-known], when I saw the "immediately," I knew that meant like right now. So I went to his office, which was his classroom with his desk at the front of it. [. . .] It was a period during which he had no class, no students, so I went in to see him. He said, "Well, what do you want to do when you get out of here?" I said, "Well, I think I'd like to be a forest ranger because I love the mountains." I grew up in them, camped, still love the mountains, still camp. But in any event, that was the wrong answer. He literally swore at me. I'd never heard a teacher swear—nothing terribly violent, but a few damns and so on—that I had no ambition and what was wrong with me and [that] I was wasting his time—and get out of here. So I left, [very offended], because I hadn't asked to be there in the first place. [. . .]

Anyway, a few days later, I get another note. Justin W. Brierley wants to meet with you immediately, so I traipsed down the hall. I can still remember thinking, "I know he's going to want an answer from me, and I know one wrong answer. And I don't know what the right answer is." [But] when I went in, he was very pleasant, didn't ask me any questions. He had two envelopes and [. . .] said, "This is an application to Williams College, and this is an application to Princeton. That's what you're going to do." I said [stunned], "You know, even if I could get into a place like that, we couldn't afford it." [But] he said, "If you can get into those places, they'll pay your way through. Go fill out the applications." As it turned out, there was a youth leader in Denver who I happened to know moderately well who had attended Princeton, so he started talking to me about Princeton. [It sounded] like a pretty neat place, so I applied. I filled out the application, and at some point in the application process, I was asked what I [. . .] wanted to study. I said . . . this is at Princeton; they're interviewing me. "What do you want to study?" I said, "Forestry." It was the funniest thing they had ever heard. And to this day, I think I was admitted as an experiment. [laughter] But in any event, they said they don't teach forestry [at Princeton. So] I said, "Well, what do you teach that's like forestry?" Whomever I was speaking with—and I don't recall [whom] it was—said to me after thinking a moment [. . .], "Well, geological engineering is like forestry." **<T: 35 min>** So I said, "Well, do you teach geological engineering?" "Yes, we do." "Okay, I'll take geological engineering." So that became my major my freshman year.

Fast forward to the end of my freshman year—and of course, freshman year, your engineering courses are pretty general [. . .]—I did have a course in geology, which frankly I didn't enjoy because it wasn't exact enough for me. I like exactitude in answers, and geology—there's a lot of judgment and guessing that goes into it. I don't mean to demean the subject, but . . . anyway, I wasn't sure I really was cut out to do that. I got a . . . let's see—how did this

happen?—I guess I was a little uneasy about it, and one Saturday night I was on a train coming back to Princeton from New York where I'd had a date. I must confess that it was probably the only date I had freshman year. Of course, there were no women at Princeton in those days, and I was scared to death about my academics. I was coming from East Denver High School to Princeton; this was, kind of, a leap for me. When I left, the Denver Post, I think it was, carried a little article about me. The headline was, "Denver Youth Attends Princeton." Anyway, I got a fourteen on my first exam at Princeton; that was 14 percent. A physics exam. I remember thinking that the headline would be, "Denver Youth Returns from Princeton." So I was pretty frightened and studied very hard. [It] turned out [. . .] that the class average was 11 percent, so they were [just] trying to get our attention. It succeeded in my case.

Anyway, I'm on the train coming back from New York . . . which was unusual because we usually hitchhiked. But anyway, I was on the train, and I ran into a guy going through the vestibule in the train between two cars. In those days, there was a chain link ["railing"] you had to walk through in the open air to get from one car to another. This other fella that I met, I didn't know [him], but I recognized him. He had been a senior at East Denver High, and he was now a senior at Princeton, and I'm a freshman. [. . .] To be candid, he had more to drink than he should have, and I was worried about him falling off the train and was trying to help [by] holding him. In moments of visiting and semi-sobriety, he told me he was studying aeronautical engineering, and that that's what I should be studying because that's where the real future [was]: aeronautical engineering. The following Monday morning, on the advice of this drunken student, I switched my major to aeronautical engineering. As you can see, this is not a story that I use to inspire young people who are trying to design a career, but . . .

I studied aeronautical engineering, and to leap forward four [. . .] years—three more years—the very week I began graduate college in aeronautical [. . .] engineering, Sputnik went up. My timing was perfect [. . .]. Anyway, that, is how I wound up being an aerospace guy.

CARUSO: So I just had a couple of questions. So, Princeton—was that the only college you applied to?

AUGUSTINE: I applied to Princeton, Williams, and Colorado School of Mines.

CARUSO: And were you're accepted at the other two?

AUGUSTINE: I was, and that was a big problem because by the time I was admitted [. . .] I'd filled out my applications and done some research, I knew that it was Princeton that I wanted to go to. I was admitted to Williams and given a full scholarship. [But] Williams College, that group, required that you make your acceptance and put down a fifty-dollar deposit—before you heard from the Ivy League schools. [. . .] So to protect my position to Williams, I had to put down fifty dollars, but I knew I'd prefer to go to Princeton—if I got in. <**T: 40 min**> It was a

terrible debate because fifty dollars in our family was a huge amount of money. In those days, it was a huge amount of money for everybody, I guess. [. . .] Fortunately, I had this friend who had been to Princeton and had some connections and he [. . .] whispered to me [that he had looked into it and said] nobody will say yes or no, "you got in," but he said the body language is good. [. . .] It looks like you're going to get in. So I took the chance and didn't put down the fifty dollars at Williams [and] lost my spot there. My parents nearly killed me. Anyway, happily, I got admitted to Princeton.

As I said, I was [also] admitted to Colorado School of Mines. [. . .] They refer to MIT [Massachusetts Institute of Technology] as the Colorado School of Mines of the [East] . . . and it's a truly outstanding, tough, small, private engineering school, [from] which I later got an honorary degree, [. . .] so it all worked out well.

CARUSO: When you'd applied to these colleges, did you have any reservations about leaving Denver? I mean, would you have preferred to stay home? You . . . . I know you went for hikes up in the mountains. You haven't mentioned much travel outside of the area growing up, so I didn't know if this was going to be your first experience really outside of Denver.

AUGUSTINE: That's a very good question. We didn't travel very much. [. . .] I had an aunt and uncle who had a farm in Wichita, Kansas—near Wichita, Kansas—a little town called Mount Hope, and every summer we would drive to the farm and spend a week or so there, which I always enjoyed. I had a cousin there. One time I was [visiting] during the school year and she invited me to go to her classes with her. [This] is a little farm town—I don't suppose there were over ten kids in each grade, and the idea that you'd go to class with somebody else and visit—I don't know why I wasn't in school, but I wasn't at this particular point—and after school, I got to practice with the basketball team and I was the star. Suddenly, I realized that [do] you want to be a big fish in a small pond or a small fish in a big pond? That was, kind of, the Princeton challenge—I was going to be a small fish in a big pond.

Even though we hadn't traveled very much, [. . .] I wanted to go to college. Although my parents and I were very close, it just seemed like the [right] thing to do. I don't recall it—going off to college—being . . . . I spent a lot of summers at camp and working on the staff there so I was used to being away from the house. So I climbed on the train [one day—the chair car]. We spent a day in Chicago. There were a lot of students that would show up on this same train, going to different schools [in the east. We would] get the Trailblazer out of Chicago toward New York and get off at Princeton. [. . .] I did that twenty-six times, going back and forth, so I got a lot of train-travel in. [Once in the spring and fall and once at Christmas.]

CARUSO: And what was it like . . . so you mentioned in your freshman year, you were in New York City going out on a date. What was it generally like transitioning from Denver to East Coast? Did you find life different in Princeton? If so, in what ways? Because I can understand

that, especially being so close to New York, maybe you were getting different experiences or life is just running differently, compared to what it was like out in Denver.

AUGUSTINE: It was very different. [But the] people were very nice, welcoming, sometimes more abrupt than people in the West [. . .], but Princeton is, kind of, an isolated little country community. [. . .] Freshman year I didn't have a lot of occasion to leave the campus, [but in my later years I'd hitchhike to New York] and [. . .] to Madison Square Garden or [. . .] Carnegie Hall or to [a] Broadway show where I could get standing room—I think it was [about a dollar] if I remember right—in the back of the theater. That was such a big treat. **<T: 45 min>** [. . .] I mean, New York was, kind of, off my radar scale in terms of being a wonderful adventure. I [settled in pretty] easily to East Coast life, although it certainly was different. In terms of the students, it was all-male whereas my high school was co-ed. It seemed like everybody was farther [ahead] than I [. . .] a lot of the kids—at least I thought—they were smarter. A lot of kids had gone to prep schools and [were better prepared than I].

Anyway, it was different, but pleasantly different. I missed not having mountains to go to, but I must admit that I was probably a little out of place. I remember talking about going "down" [. . .] to New York and up to Philadelphia—which, of course, from Princeton, [. . .] was just backwards. Everybody kind of asked, "Where did you get that from?" "Well," [I explained], "because Philadelphia's closer to the Continental Divide than New York [since the train from Colorado goes through Philadelphia first], so you go 'up' when you go to Philadelphia." [. . .] That would get a lot of laughter, but I didn't know any better.

CARUSO: And so you went to Princeton on a full scholarship?

AUGUSTINE: I did. I was there six years and never paid a penny [of tuition. But, actually, Princeton doesn't literally give "scholarships"; they are only based on need.] At that time, it cost about two thousand dollars a year total wrap-around to go to Princeton, and tuition was six hundred dollars, which I got from the university. My dorm room was ninety dollars, food was 480 dollars a year. I worked as a waiter for Howard Johnson's restaurant [where] I could make 480 dollars, and then I had the train fare to-and-back at the end of school year and at Christmas—[. . .] I could make five hundred bucks in a summer job [spreading tar on roofs, my parents provided five hundred dollars] and you add it all up and it comes out to two thousand dollars—it works.

CARUSO: Were the students that you entered into Princeton with or, more generally, did they come from similar financial situations, or where are they from different economic classes when you were there?

AUGUSTINE: Really quite a mixture. Money was . . . as I say, I've always had plenty—I've had clothes, I had everything I ever needed, [I just] didn't have any of the luxuries [that some had] at Princeton. But my two closest friends [in] freshman year—both football players, both from [. . .] Ohio—one of [their fathers] was a foreman in a steel mill [. . .]; the other one was vice president of a large corporation. Those were my closest friends. [. . .] I never felt any particular distinction. There were the [Rockefellers], DuPonts, Firestones, and so on there, but I never felt any particular [distinction. Junior year] you became a member of what [were called an] eating club. We didn't have fraternities at Princeton (or sororities today [. . .]). There was one eating club you pretty much had to come from a fancy background, [but other] than that, we were all in it together, I would say.

CARUSO: Okay, you also mentioned that your graduating class from high school was larger than your entering class at Princeton, and you said that you know when you're in high school, when you went, you know, you thought you could maybe play basketball, but there are so many other kids that were better that comparatively, you weren't as good. When you went to Princeton, did you try to join sports teams while there, and did you try to rekindle your interest in basketball or some other sports to join an official team, or did you just focus on your academics?

AUGUSTINE: Between the academics [of engineering school] and having a job **<T: 50 min>** waiting tables and a few other little jobs I had from time to time [to pick up an extra nickel—parking cars at football games, tutoring math for fifty cents an hour], and things like that—I didn't have time [. . .] to participate in athletics at the intercollegiate level, nor was I good enough. But I played some intramural basketball and volleyball, but my [athletic involvements] dropped a lot. I must confess [so did] my knowledge of what was going on in the world. [. . .] I read now about things that [were going on in the world that] I was hardly aware of. [There] was only one TV [. . .] and that was in the club, the eating club, which I couldn't join till junior year, so we didn't watch TV. [. . .] I couldn't afford newspapers—didn't have time to read them anyway. It was really kind of contrary to what you would expect of a university—[I was] fairly isolated from the news of the world during those four years.

CARUSO: So I . . . so like things in terms of the escalation of the Cold War, communism, concerns of communism in the US, you weren't being exposed to that on the campus or necessarily hearing about it while you were at Princeton?

AUGUSTINE: [Even] studying engineering at Princeton, they require [you] to take a lot of liberal arts courses, but I did not take history courses and so somehow I really wasn't immersed in [global issues]. The Korean War was over; Vietnam was a place we had never heard of at that point. The Cold War was going on, and we were well aware of that. [We] were pretty much in what they would call [a] cocoon today—or your bubble around the campus. [Of] course, the

space program among the engineers was [of] particular interest, [but] the fact we were losing to the Russians [in space had not yet occurred to anyone].

CARUSO: So you mentioned the fortuitous meeting of someone on a . . . a student on a train—a senior at Princeton—who you had been aware of back in Denver and you know after speaking with the individual, you know, the next day you're switching your major to aeronautical engineering. And I'm guessing at this point in time, you probably had a better sense of what an engineer was, right? You mentioned that in Denver, you don't think you ever actually met an engineer, but you're getting a sense of what engineering is, what an engineer does, you're now moving into aerospace engineering. What were the classes like when you started . . . when you moved into that major? Was it still pretty standard intro engineering courses, or were you being introduced to something different, specific to your area of interest?

AUGUSTINE: [My] freshman year, of course, was physics, chemistry, math, [and the likes]. I took [courses in] Shakespeare, [European literature], and descriptive geometry. [. . .] But by sophomore year, we were starting to do things that had to do with aeronautics. There were the classic courses one takes in the field—a lot of [theoretical] aerodynamics. Princeton, at least at that time—and I think still does—heavily [emphasizes] fundamentals [and] theory. [Practice mostly came in when you had a job]. I had a very strong fundamental background, but as I discovered when I later went to work, there were a lot of graduates from other universities that had a lot more real-world practical experience. On the other hand, the [fundamentals] served me well because that part lasts forever. **<T: 55 min>** The courses were heavy in math, needless to say, and I enjoyed them.

There were only nine aeronautical [engineers] in my class—[Princeton had a huge aeronautical engineering faculty], but [. . .] there were only nine students [in my year so it was almost like getting private tutoring. Later] we did get into [a few] more practical things; we did flight testing, which I particularly enjoyed. We had a Navion, [. . .] a single-engine propeller [aircraft], and Princeton had a grass runway out at the research center for aeronautics, and one of the professors—Professor Perkins, "Court" [Courtland Davis] Perkins, who later became chief scientist for the Air Force—would pilot. The airplane would hold three [students], and we would go up and pull Gs and measure what you could measure. He liked to pull a lot of Gs, and we had a little instrument we had devised that you held in your hand and it would tell how many Gs you were pulling. The [student] in the front seat—in the co-pilot seat—would call out the number of Gs, and [in] the back seats we would write down the data. We finally worked out a deal [where] we added half a G to whatever it [really] was to get him to back off on how many Gs he was pulling. [laughter] But that was fun, and we did a lot of wind tunnel work, which was [also fun. We had] good teachers, some of them [. . .] well-known in the field. It turned out to be the right choice for me. [In later years when I would fly in the backseat of a supersonic fighter aircraft our company built, the pilot once warned me that "the wings depart the aircraft" at 10 Gs! It was interesting that in the particular years when I was CEO of an aerospace company, most of the companies in the industry had Princeton graduates as CEOs: Boeing, McDonnell Douglas, Hughes, Grumman, Westinghouse, Lockheed Martin . . .]

CARUSO: So while you were there . . . so I'm familiar with work in the sciences more specifically, I was . . . I did my undergraduate degrees initially in biomedical and chemical engineering. And I know that while you were doing your courses you were also encouraged—not required—but encouraged to do independent research—you know, work with a faculty member in her or his lab. When you were an undergraduate, were you doing any close specific research with faculty members that was taking place outside of the classroom? I know you were busy with working jobs and things like that. You didn't have time for sports, but I was wondering if there were these opportunities and if you participated in opportunities to work more closely with a professor on an independent research project during your undergraduate years.

AUGUSTINE: There really wasn't until senior year. [That] year I became a research assistant, and that was, kind of, a strange story in its own right. I had become what was called a "waiter captain" at Howard Johnson's where I was working in the restaurant. It was a step up from waiter; you, kind of, were in charge of other waiters. And so, I was offered this job as a research assistant, which I was really excited about. The research that we were going to do was interesting, so I [. . .] turned down the continuation of my job as a waiter captain. [Being] a waiter captain was high-paying job. [. . .] Anyway, I accepted the job at the research lab and hadn't remembered to ask what it was going to pay. [. . .] I had been averaging probably two dollars an hour as a waiter, and the pay as a researcher was fifty cents an hour. I thought, "Yeah, getting all this education, and my salary is going down at every step." During my summers in college, I [. . .] got $1.69 for spreading tar on roofs in Denver. **<T: 60 min>** So now I'm going to be a research assistant, and I'm going to get fifty cents an hour!

Anyway, I managed to put the pieces together and make it work financially [by working] lots of hours and loved it. The project that I was doing was one in aeronautics. It involved some theory [and] a lot of wind tunnel work. I entered [my report] in a contest [in] aeronautics for all the schools in the northeastern United States. I took second place. My professor, at the end of the semester, who had become kind of a friend and a mentor, [gave me the] equivalent of a B on it. I [asked him], "How can I have the second best project [in the northeastern] United States and get a B here at Princeton?" He thought for a moment and then he ["explained"]: "Because that's the way it is," [and] walked off. But I really enjoyed the research part. [. . .] Of course, in graduate school, I had a research project [. . .] which was pretty much done on my own—not an awful lot of faculty guidance. [. . .] We had a contract with the Navy and [I was carrying out one part of the] contract for the Navy.

CARUSO: So that was something else I was going to ask about is whether or not the professors that you were taking courses with, the professor that you end up working with for your research project in senior year . . . were you aware that, or did they have government and possibly also private contracts that was funding their research?

AUGUSTINE: I was. Much of the research that I was involved with was funded by the [. . .] ONR—Office of Naval Research. Once in a while somebody from the Navy would show up, but it was rare, and the things we did would basically be incorporated into reports the faculty put together. We were doing little pieces of the projects. [. . .] The faculty [was also] doing consulting work for companies and [. . .] were writing a lot of books. That was viewed as good from our standpoint because they had [some] interesting experiences and stories [. . .] they could tell us about [. . .] based on their work outside of the university. [. . .] There was a visiting faculty member from Boeing who was there for a year [and] taught a course in aeroelasticity. That, kind of, gave us [insight] on what the real world might be like outside of college.

CARUSO: So you mentioned that your class had nine individuals. I'm assuming that that discipline didn't have too many more people per year in the classes that were ahead of you, right? Roughly similar numbers?

AUGUSTINE: That was pretty typical. [There were also graduate students at the same time. But I was] an undergraduate during the years I'm describing. [The Air Force and Navy used to send one or two young officer] to get a master's degree at Princeton in aeronautics each year. We had a fair amount of time [. . .]—particularly in my senior year—with those fellows who were pilots in the military—test pilots—and [they were] learning the theory [behind] what they did in the real world. We, kind of, learned the opposite [perspective] from them.

CARUSO: The reason I was asking my question is I was curious . . . . I'm assuming that the classes that were ahead of you, you were hearing about individuals who either decided to continue on with an education and pursue a master's or PhD. But there are . . . . I'm assuming there are also many that wound up leaving and going out for jobs. And I was curious to know what were you hearing about the potential job opportunities for someone <**T: 65 min**> leaving Princeton with the degree that you were pursuing?

AUGUSTINE: Let's see. [. . .] About a third of the [freshman] engineering class [. . .] at Princeton [actually] completed their degree in [. . .] engineering. About 98 percent of those who started received a degree in [some field in] four years. So there was filtering by subject, but everybody graduated, and we had summer jobs in industry. [. . .] I finished putting tar on roofs and got jobs at companies—General Dynamics and [. . .] Boeing. So I had some perspective of what was happening out in the industrial world. It was a [critical time] to graduate from college in [aeronautics] because the Cold War was on, the space race was just beginning, [commercial air travel was expanding. Out] of the nine of us who were aeronautical engineers, nobody dropped out. All of us stayed with it. We did talk to [former] students [and] they were making more money than I knew existed in the world. [. . .] I went to work for Douglas Aircraft when I graduated. [. . .] That's a story I should tell too about research, [and] they quoted my pay based on a sixty-hour [work] week. We really worked sixty-hour weeks in those days. [. . .] And it was time-and-a-half for the [twenty] over [forty], so if I got the arithmetic right, you were making

about three quarters more [than the normal work week]. So money was no longer a problem for the first time in my life. I was working in Southern California—I'm getting ahead of the story here . . .

So when I was in graduate school and undergraduate school, it was clear that this was an exciting profession [at the] leading edge of the state of the art. [. . .] If you wanted [to do things that were] state of the art, you wanted to work on military [systems.] You became involved in national security, so that's what drove us to that direction.

CARUSO: And I'm also curious to know. So why is it that you decided not to end your education with a bachelor's degree but decided to pursue the master's?

AUGUSTINE: Good question. The faculty [. . .] at Princeton pretty much urged you to get [at least] a master's degree. [. . .] I never even dreamed of a PhD. For one thing, I was out of money, and [second], I was [. . .] tired of studying. [. . .] I guess it was mainly the faculty that, sort of, said, "You really ought to get a master's degree." I believe that most everyone in my group of nine did. I applied to MIT and to Princeton, and was [. . .] admitted at MIT [and] intended to go there—[until another fork appeared in the road]. Princeton got a nice grant from the Navy to perform some research that I was particularly interested in, and [working on] it would pay for my [research]. I had a fellowship for tuition, so I decided to stay at Princeton. [. . .] Also, at that point, [. . .] MIT was known as a very heavy [. . .] engineering school, whereas I'd had a lot of liberal arts and the likes in college, and I wasn't sure that I was up to, would be capable of performing [in] a really tough engineering-focused school. [. . .] I think my logic was [. . .] poor, but <**T: 70 min**> I was [happy, and it worked out fine].

CARUSO: The master's curriculum at Princeton, you mentioned that you had a research project, it was for government, it was paid for through a grant. I know that the thesis that you wrote was on a supersonic trainer, correct?

AUGUSTINE: That was for [my] undergraduate senior [project].

CARUSO: That was for undergraduate, okay. The supersonic trainer was undergraduate. Then what was your focus for graduate school?

AUGUSTINE: [. . .] My thesis was [on] the dynamics and aerodynamics [of a] vectored slipstream aircraft with a double-slotted flap—pretty exciting stuff! [. . .] The good thing about it was it posed interesting theoretical questions. [. . .] I'm a woodworker [so I could build my own] models and put them in the wind tunnels. As a matter of fact, I had to modify a wind

tunnel so that it could [do] what I was trying to do. I spent a lot of [evenings at] the wind tunnel collecting data.

CARUSO: So this is the first time that you mentioned that you are woodworker. When did that start? Was that something that you'd been interested in as a kid, or was it something more of a college experience?

AUGUSTINE: I had a grandfather who lived with us until he died when I was about [four years old. He] was a carpenter and had some tools and even at that young age he would show me how you use a saw or [other simple tools]. And because I had no brothers and sisters, he was, kind of, my best buddy. I could remember—I think it affects me to this day—that when he died, I couldn't figure how my best friend could just leave, [not] say goodbye or anything. Four years old, you don't figure those things out. Anyway, he got me interested in woodworking, and then after he was gone, the house we lived in had an old coal bin—it was a room in the basement where they poured coal through the window at ground level and [stored] coal for the furnace. Our furnace had been converted to gas, so I cleaned out this coal bin and converted it to a woodshop. [. . .] I could go [. . .] to the grocery store and they would give [me] the boxes that oranges came in—the orange crates—and I could use that for wood. [. . .] I built all kinds of stuff. And to this day, I still do woodworking. [. . .] I was on the board of Black and Decker so I [now have] a world-class shop. I enjoy that very much; it's a tangible thing.

CARUSO: So I have to ask this as a follow-up question. So I did Cub Scouts, Boy Scouts, and I remember having the races like you would—I forget what they were called—you would make the little cars and run them down the tracks, you had the regatta where you would build the boats and run them, you know, and have races with them. Did you do that in Boy Scouts?

AUGUSTINE: I did, and I continue doing it through my grandsons. [. . .] In the last year, I was helping build the cars. ["Pinewood Derby"].

CARUSO: And so I was wondering how well you did in those races given that I don't know . . . like I never had woodworking skills when I supposed to carve these things and race them. How did you actually do in those races?

AUGUSTINE: Did very well. But the secret to that is getting very good lubricants. [. . .] It's legal [to] use whatever lubricant you want. For my grandkids, I got the lubricants they use to oil the bearings on jet engines, and boy, I'll tell you, the cars move. [laughter]

CARUSO: Sorry, I didn't mean to . . . so you've mentioned the woodworking, model-building, working in the wind tunnels. So that's what you were doing for your graduate degree. During the master's program, did you have to take courses as well, or was it really just a focus on that research <**T: 75 min**> project?

AUGUSTINE: There were courses [. . .]—by and large, very theoretical. I don't remember [any] labs in graduate school. May have been, but I don't remember that. [. . .] You had your thesis that was a hands-on project also involving theory. Our undergraduate projects were done as a team whereas your graduate project was just yours; you were on your own.

CARUSO: Okay. Now I know that you mentioned that Princeton—I think it was up until the mid-sixties—was . . . their undergraduate institution was men only. I know [Johns] Hopkins [University] and a number of other institutions were very much the same during that period of time, but I'm also aware that Hopkins did allow females in their graduate schools. Did Princeton allow women to enter their graduate school?

AUGUSTINE: Not [until] about ten years after I graduated. There were no women faculty, no . . . it was a monastery at that point. On weekends—studies were pretty demanding—but on weekends, we could hitchhike to the various women's schools on the East coast, and a couple [of] weekends a year, the [eating] clubs would [. . .] all get together the same weekend [and] have big parties[: we] would have dates for the [entire] weekend. They would stay at people's homes in the town. The townspeople at Princeton were nice [. . .]—knowing that we weren't allowed to have cars—so people close enough to the campus [made rooms available] for two dollars a night. [. . .] It sounds pretty quaint today, but it worked very well.

CARUSO: So you mentioned that you were, kind of, done with education. You weren't going to pursue a PhD. How did the opportunity . . . so, I mean, you mentioned you started working for Douglas Aircraft in California. How did you either learn about or encounter the company? Did they send recruiters to campus? Was this something like your thesis advisor is like, "You know what, you should go work for this company" and just send you off? How did it come about that you wound up working for Douglas Aircraft?

AUGUSTINE: There were a couple of factors—one of which I probably shouldn't be proud of [as a criterion]—but Southern California sounded like a great place to be as young bachelor. [. . .] The other [. . .] was that companies sent a lot of recruiters. We were very much in demand. You could have all the job offers you wanted. [. . .] At that time—[and] it shows how things change—[. . .] Douglas Aircraft was, kind of, the New York Yankees of the airplane business. They were the ones who [built the] DC-3, the DC-6, and you go down the line. [. . .] The Thor missile and Nike Zeus. [. . .] They really were kind of the dominant company. People from Boeing would be offended by my having said that, and certainly Lockheed [and Martin] would,

but I think the truth of the matter was it was a very good place to work. [. . .] So I applied for a job [. . .] in the aeronautics part of the company because my thesis was in aeronautics. [But] when I got out there to go work [on the job] was in the Missiles and Space Division [. . .], up the road ten miles from the aeronautics part of the company. I was in a division I really hadn't intended to be in, but I got interested in what they were doing right away. And [. . .] kind of contrary to my [earlier] experience [. . .], when I got there I was really eager to build something, to fly airplanes, or as it turned out [. . .], missiles. **<T: 80 min>**

[But they] wanted to assign me to the research group, which was a small group of about [a dozen] people in the [missiles and space] part of the company. I didn't know it at the time, but everybody in the group except myself had a PhD. [. . .] Well, I was tired of researching. [. . .] I wanted to build something. I remember complaining to my [new] boss [. . .]: "That's not where I want to be. I want to work on a project somewhere." They were building a lot of neat stuff at that time. Finally, he said, "We'll take you down to meet the "Big Boss", and you can make your case." So I went down and met the "Big Boss," Jim Gunkle, and told him I really didn't want to do research, and if I'd wanted to do that, I would have stayed at the university. He said, "Well, we really need you in the research group. And if you'll go do that for a year, then you [can] have your choice within his part of the company of any job that was at my level that I wanted." So I said, okay [and I] went to work [in] this little research group of a dozen people doing very fundamental aerodynamic research. [I really] liked the people, enjoyed what I was doing, tumbled [onto] an interesting little theoretical [analysis]. It was one of these very elegant mathematical things where terms cancel out [and everything falls into place. It gave] an interesting [way] to analyze [flowfields downstream of slender blunt bodies at hypersonic speed]. I wanted to run a wind tunnel test of [the] theory to prove that it was [correct], which I got to do, and it worked out really well. So I enjoyed that. At the end of the year, they said, "Okay, do you still want to leave?" I said, "Well, I think I should." [. . .] I had no intention of getting a PhD; I was going to night school, but not for a degree—just taking courses in aerodynamics and [electronics and space and so on at University of Southern California and University of California, Los Angeles]. So they said, "You can work [on] one of the [development] projects."

I worked on the Thor for a [very little time and] the Skybolt—for a little while and then I worked on Nike Zeus, which was a fabulous assignment, Nike Zeus—this was 1959—was flying Mach eight-and-a-half in the atmosphere and it was pulling 20Gs off the launchpad, and [. .] pulling 20Gs laterally both in the atmosphere and out of the atmosphere. I mean, there was nothing [else] even vaguely approaching that. So it was true pioneering, and we were flying missiles about once a week either at Kwajalein Island out in the South Pacific or at Point Mugu in California or at White Sands, New Mexico. Unfortunately, we were having lots of failures, and I was put in charge of a little group within the aerodynamics section [and] had six or eight people working for me. Our job was when there was a flight failure to figure out if it had anything to do with aerodynamics—why the failure occurred. And I just loved the work—probably the best job I ever had. It was like detective work where you knew the [outcome] but you didn't know the reason, and you had to work back to figure out what had happened. It was [like the early space program where] somebody twenty-two years old had every bit as much

experience [. . .] as somebody sixty-two. “In the Valley of the Blind, the one-eyed man is king.” It was really true.

CARUSO: I mean, you’re going to work in aeronautics at a very interesting time in US history, right? You . . . your undergraduate you received your bachelor’s degree around the same time as Sputnik, if I—I’m trying to remember my space history—I believe that in this period of time as well was when the US was trying to launch things. They had some very spectacular failures happening **<T: 85 min>** where missiles would just, sort of, collapse on themselves and fire explosions, or they would take off and then flip and crash. And so while it was an exciting time, it was also what I assume might be a very stressful time given the failures happening. Were you aware of that? Were you feeling that? Was that being expressed while you were at Douglas Aircraft, or was that, well, you know it happened, but it wasn’t necessarily a big deal?

AUGUSTINE: Very interesting. There was [. . .] indeed an immense feeling of pressure because [. . .] when Sputnik [orbited it] was a terrible shock. There are certain things in your life you remember—9/11, Sputnik, World War II, [the Great Depression], of course Russia was a big threat. [. . .] By this time, ballistic missiles [of] intercontinental range [were out there]. Russia was a scary threat and [vastly] outnumbered us on tanks in Europe, and so on. We thought our big [advantage] was technology; and all of a sudden, the Russians were able to do something we weren’t able to do. [. . .] Anyway, rockets were blowing up and the Russians were clearly ahead of us in space. Then President [John F.] Kennedy [. . .] made his major announcement that we were going to place [. . .] men on the moon [in the] decade. That really turned [aerospace] emphasis in that direction.

[. . .] The other side was the [military] program. Once again, [that] program was designed to stay ahead of the Russians, and one of the consequences of that was there was a much greater willingness to take risks. We tended to learn by our failures. [. . .] To launch a rocket or [airplane] and have it fail wasn’t the end of the world. [Every new] airplane that was developed would lose four or five test pilots. Rockets would fail. The task was to figure out what went wrong and then fly again [as] soon as you could. [This contrasts with today where if a test aircraft or rocket fails], the whole program will be canceled. [. . .] It was a totally different kind of engineering. The Russians did something very akin to what we [were doing on Nike Zeus]; they launched in groups [of three. If all three would fail, they’d stop and figure out why they failed and then three more would go].

CARUSO: So I know that you are at Douglas from ’58 to ’65, correct?

AUGUSTINE: Yes, you’ve done your research [well]. That’s correct.

CARUSO: So, are there things about those years that you'd like to discuss as they either relate to the work that you were doing then, or what may be relevant for us to know in terms of your future career?

AUGUSTINE: I guess a couple of things happened. One was that although I was working on what they called "projects," like developing a missile or airplane or something—mostly missiles and space—I was still very fascinated by the theory, the foundational background of why what we were able to do worked or didn't work. [. . .] I maintained close contact with the people in the research group. Some of the things I'd been interested in I continued to do, sort of on the side. <**T: 90 min**> [. . .] There were usually a couple professors at universities who [. . .] spent summers with us in this little research group, and I'd get to spend time with them and learn about what they were doing. That was one of the vectors that I found myself on. [. . .] The other thing that wasn't particularly [. . .] planned—[it just turned out—was that] I started having people working for me. [. . .] I was sort of drifting into management without realizing it. [. . .] I had six or seven people [working for me and in] the next group, I had maybe [. . .] twenty people working for me. [By the end of my career it was 180,000 people. Without] ever making a decision that I wanted to move in the direction of management, I was doing [just that]. I was trying to balance my regular day-to-day [responsibilities]—the management aspects—and my fascination with [. . .] research at the same time. That certainly impacted me in terms of where my career and my interests headed as the years went on.

CARUSO: How was it switching into management? I'm assuming . . . so when I started working here at the Science History Institute, for example, I'd never had people reporting to me before, so I, kind of, had to figure out how to be a manager on my own. How was it for you learning to become a manager?

AUGUSTINE: Gosh, [. . .] there were no such things as management courses at Princeton [. . .]—they don't have a business school. Nobody I knew when I grew up was a manager. [. . .] My college roommate's father was an executive, but I guess [for me it was in] on the job training. [. . .] I remember watching other managers in the area, not with the intent of learning from them in particular [. . .], some of them I thought were pretty good; some of them were pretty awful. There was one that [. . .] ran a group just on the other side of one of these little walls—six-foot-high walls, five-foot-high—who berated his people, used foul language, but had moved up [. . .] in the company. I was really disappointed to see that; not a person you'd want to emulate. [. . .] I tried to be as different from him as I could. And then I had a good boss, [and] his . . . my boss's boss . . . was a great boss. [He was a highly respected] guy, highly ethical, a good engineer, [and] people just loved to work for [him] and would work hard for him.

If I get too far off here, please, David, feel free to interrupt me—but one experience I particularly remember, we were launching Nike Zeus—that was a very high-performance [rocket]—from White Sands. It was to be the first launch from an underground [launch] cell with no venting. Just set it down in the cell and [light] the candle. The rocket motor [. . .] burned

only four-and-a-half seconds [and produced 450,000 pounds of thrust], and that was it for the boost phase. When the missile started [. . .] coming out of the cell, the hot gases from the motor were going out of the cell faster than the missile [. . .], so the missile was flying backwards for the first part of its flight [in hot gasses]. Now this was before the days you had microelectronics and integrated circuits and all these things that make things fly. [. . .] I was given the job of **<T: 95 min>** figuring out how [to] get this thing to fly backwards as it flies out of the cell. My little team of people—seven or eight [. . .] at that time—it was a very tough job. Believe it or not, we made a little model [using] bottled air canisters and [part of] a broomstick for the missile. The program made lots of money, but that's what we did because we could do it fast. We [also] did a lot of theoretical calculations. [. . .] We had figured out that the loads on the fins on the missile would be so great—the tail fins—that they would break off. So we went to the structures people and said, "The tail fins are going to break off coming out of the cell." [. . .] They did a quick fix, if you will, to strengthen them. So I go down for the launch [at White Sands and] they do the countdown [and] the rocket comes flying up out of the [hole. It looked] like the world's largest Roman candle, coming out in thousands of pieces. [We were] watching safely from a launch [control building a mile away]. I, sort of, was responsible for figuring out, [preliminarily], what happened. I figured maybe the fins must have broken off. It was our fault.

After the poisonous gases allegedly escaped [from] the cell, they put me on a Bosun's chair from a—what do you call it?—a crane and lowered me down into the cell. I'm afraid of heights, so it was a bad deal to begin with. They lowered me down [into] the cell [and I had] a flashlight. I'm looking for any pieces or anything and the grease from the rocket motor exhaust that collected on the side of the cell. There were two [parallel] marks going up the side of the cell [. . .]—and it was instantly clear to me what had happened. [. . .] The fins had not broken off, [but] it had not occurred to us that the loads on those fins would be transferred to four bolts—twenty-five cent hardware [store] bolts—that held the missile on the rail that it was supposed to slide up as it went out of the cell. Well, those four bolts failed, and [the missile banged up against the cell wall] and cracked the grain of the rocket motor and [. . .] it blew up. The evidence was very clear. [. . .] I went back to see the ["Big Boss"]—John Thomas—who we all respected so much and [I] went through with him exactly what [had] happened, what we had missed, and I figured this is the end of a great career. John looked at me [and] said, "You've done a great analysis [of the failure]; you've been very honest." He said, "I'm sure you learned a lot from this. Let's hope the next [flight will be] better [and the next missile better]." As I said, this is the kind of guy [people] want to work for. He would not have been tolerant of negligence, but it was an honest oversight—the people in the structures section didn't catch it either. [. . .] I learned from people as I went along. I never had any [formal] training in [leadership, management or business but I was pretty good at finding capable people to work with].

CARUSO: You raised something else that I guess maybe people who'd be reading this interview at some point in the future may not consider, but what was it like doing these calculations prior to having modern computers, right? Did Douglas Aircraft have their own computer, or did they have what computers originally were, which were people who ran the calculations for you? Can tell me a little bit more about the mathematics and figuring out the answers at that point in time?

AUGUSTINE: [Great question. It] was [a] totally different world. [. . .] In one of my summer jobs at General Dynamics, I was calculating a transfer orbit to Mars [. . .] with three pieces of wood and two pieces of glass—called a slide rule. **<T: 100 min>** And I have it here on the wall in case . . . right now it's [framed in a box with a little hammer] that says, "In case of power failure, break glass." Most of our calculations were literally done on the slide rule. There was a small digital computer [for the entire engineering group and also some analog computers]. The first Hewlett Packard [hand calculator was] expensive as the dickens. [. . .] The slide rule was 19.95 USD with your name engraved [on it].

We also had a group that [was called the "computers"—the human kind]! They used two kinds of [machines], either a Marchant or a Frieden. [As I recall, they] were like a typewriter except [it] was a calculator—a mechanical calculator—with gears, and so on. They were [electrically] run, but there was nothing electronic about [them] except to move the gears. [The operators] would sit in [a] group—they happened to sit next to me [in what was part of the aeroelasticity group—and] would solve aeroelastic equations, which had these awful matrices [. . .] to invert. [. . .] They worked in pairs [. . .]—there were about twenty or thirty people. [If an engineer had] a problem to be solved, [they would prepare] a matrix that would say add column one to column three, divide by column seven, subtract column two, and [the "computer people"] would go through and fill out the matrix using these mechanical calculators that made a terrible racket as they whirled [on and on]. The [operators worked in pairs doing] the identical problem, side by side. They would have an alarm clock, [. . .] and every ten minutes the alarm clock would go off, and they would check with each other to see if they had the same answer so far. [Big fights would] break out every ten minutes, "You got it wrong again; you keep getting it wrong." And if they didn't agree, they'd go back and do it again until they got [agreement. If they got agreement, they could go on to] the next ten minutes of the calculation—[and see if they still agreed. If] they got clear through the calculation, there was a pretty good chance it was right. If you were an engineer, you'd give them the problems in the morning and then you'd wait and hopefully get [them] back that day or the next day or something like that. Pretty primitive. Blueprints were literally blueprints. ["Slides" were 8 ½ by 11 "greasies" you wrote on with crayons]. With [all] that, we developed a missile that could fly Mach eight-and-a-half and pull 20Gs, and [we] did a pretty good job of it.

CARUSO: So I know that you finished your time at Douglas Aircraft in '65. You enjoyed the Southern California life for about seven years. What made you decide to move on from Douglas Aircraft and begin serving in the Office of the Secretary of Defense?

AUGUSTINE: To be perfectly candid there were several things. One was that Donald [W.] Douglas Sr. who had founded the company retired and turned the company over to his son, [Donald Willis Douglas Jr.] who I've come to know in later life. [But he] was probably not equipped to run a company like that and made a couple of decisions that were mind-boggling in retrospect, how bad they were. It was driving the company into the ground. And it wasn't that I

was so worried about the company failing, it was just so frustrating. The classic **<T: 105 min>** [thing] that impacted me and an awful lot of other people is an example of a management error that [harmed a company that until then was], as I said, the gold standard of the business. One day, my boss's boss that I liked so much—we all did—John Thomas, [on a] Friday afternoon, at the end of the day, at that time we all worked in the upper level of a hanger. When [aircraft] companies went into the missile [. . .] and space business, they didn't need these huge hangers, so they would put [a] deck on a hanger and all the engineers would work [there. We] referred to [it as "acres"] of engineers [. . .] probably three [or] four hundred of us up there with desks lined up side by side. Birds would get in the hanger and fly [around] and every now and then, you'd hear somebody scream! [. . .]

John, late one afternoon on Friday, [motioned] us all to get together. [We] all gathered around, and he [climbed up on a desk and] said, "I have some very bad news for you that I really don't like to have to convey." I should give as a way of background, the industry is doing great; business is great at this point. And he said, "Starting Monday, you're [all] making 15 percent less than you are today." There's this silence in the room. Then somebody realizes it's April 1 and yells, "April Fools!" John turns purple, and we're all cheering and yelling, "April Fools!" John said, "I wish this were an April Fools, but this is not." Well, we all think he's really pulling this off, so we're still really cheering. Finally, he convinces us, and the newspaper the next day convinces us it was not a joke. What had happened apparently was [that the company's new CEO, Don Douglas' son, had been] told we needed to control [. . .] costs and that the major cost element was personnel. He said, "Cut everybody's pay 15 percent," which [he] did. Within a week, we had an engineers' union, which is totally contrary to the attitude of most engineers. [The headhunters . . . this was] Los Angeles, [California], where you could go to any one of four or five aerospace companies [. . .] and not move your home—just by driving a different direction. The very best people started bailing out, particularly the younger best people. Most of the people I was working with bailed out and went to other companies. [. . .] That was one big factor [in my decision to leave].

The next big factor was that [. . .] the company decided the way to write proposals [for new business contracts] was to get people who basically [became] professional proposal writers. [They] would get to be really good, which is a great idea, except proposal writing is a killing experience. It's [a] twenty-four-hour, seven-day-a-week job. Anyway, I was assigned to this proposal writing group to [. . .] bring in new business. We would write a proposal I thought was pretty good, and we'd lose. We'd write one that I was kind of ashamed of, and we would win. And I remember saying to myself, if I'm going to make a living in this business, I better find out how you tell the difference between a good proposal and a bad proposal. [. . .] Maybe what I ought to do sometime is [. . .] learn to write proposals by evaluating proposals [of others and maybe] get a job with the government where I could evaluate proposals. I mentioned this to one of our marketing people [. . .] who happened to work in Washington, [D.C.], most of the time. A fellow by the name of Dave Halloran. [. . .] His Washington contacts had [told him] that Robert [S.] McNamara, who had just become Secretary of Defense, [. . .] was looking for young, enthusiastic, inexperienced people—and I fit the description to a tee. My friend David said he'd mentioned this and that he thought they'd probably like to have me come [to work in] the Office of the Secretary of Defense. [. . .] There was an organization there called the [Office of the]

Director of Defense Research and Engineering, which was one of the two most powerful elements in the Office of the Secretary of Defense [at the time. It was] very small in those days; it's huge now. **<T: 110 min>**

[. . .] Anyway, they offered me a job, [but] it turned out to be a very inopportune time. We had a two-year-old and a baby about to be born, [. . .] so I negotiated that I didn't have to show up for work until the baby was born. Two weeks after she showed up, we packed up, sold our home [in Pacific Palisades for 33,500 USD], moved into a rental home in Washington, took a big pay cut, and I went to work in the Office of the Director of Defense Research and Engineering [DDR&E] in the Office of the Secretary of Defense, which was a career-changing event. I think one of the lessons is that a lot of things in life aren't very convenient. A fellow who used to run Lockheed [liked] to say that if opportunity knocks, try to answer the door. This was one of those cases of trying to answer the door. Anyway, we settled down in Washington. The folks at Douglas weren't at all happy with me, kind of, bailing out, but everybody else was bailing out, too. Then they rescinded the 15 percent pay cut and six months later, Douglas was owned by [their big competitor] McDonnell. [. . .] I guess that sort of wrapped up my career at Douglas.

CARUSO: So you haven't mentioned being married. When did you meet your wife [Margareta "Meg" Engman Augustine]?

AUGUSTINE: I was in graduate school at Princeton. This part of the story is not a particularly good part of the story! She was dating my roommate [in] the graduate school. I first met her on a weekend. There was a lake not far from Princeton [where a group of us went water skiing. My] roommate was there with this attractive young girl from Sweden. She was born in Stockholm, [Sweden]. She was [working] as an au pair in New Jersey and had just come to America. I [partly] remember the day because when I worked at Boeing [the summer before], I had done some water skiing in Lake Washington. I'd never . . . being from Colorado [. . .] learned to swim. There's nowhere to swim in Colorado. [. . .] So they had these little belts—it was called skier's belt—and so that day in New Jersey, I wanted to water ski, so [. . .] I bought a skier's belt. The first time I fell, I fell hard, and the belt disintegrated, and I can remember going to the bottom of the lake. It wasn't that deep. [. . .] They came back to get me [and] as the tow rope went by, [. . .] the tow rope was low enough in the water that I could see it, [I climbed up the tow rope]. I didn't know how to swim a stroke. I climbed up the tow rope and got back to the boat, and that was the day I met my wife to be. Memorable [in] two regards. [. . .] After that, when I got to California, I took a course [at the YMCA] and got a license to scuba dive.

Anyway, so now I'm at Douglas Aircraft and this pretty girl I met in New Jersey is still in New Jersey as an au pair and is about to finish her commitment to that. She came to America with nothing in the way of financial [assets. She] had gotten a job at the UN [United Nations] as an interpreter, but it wasn't going to start till the end of the summer. [She wanted to see America], so she got a job driving a car for Avis or Hertz or somebody to California that they wanted delivered there. My roommate, who is still on the East Coast, writes to me and [says],

"Meg is going to be [. . .] in California and would you show her around while she's out there?" [She comes out to California]—he didn't say how long I was to show her around. It's now been [sixty] years. [laughter] Anyway, he and I are still friends. He met another girl from Sweden, interestingly, and he married her. [Meg and I had two] children and have had [sixty] years of a happy marriage.

CARUSO: Yeah, so I just wanted to follow up on that since you mentioned you know **<T: 115 min>** essentially when you're moving out to the to the DC area, it was I think you said a two-year-old and a newborn. Is that the ages?

AUGUSTINE: Right. [One, two years; the other, two weeks].

CARUSO: Right. And so that must have also been a complexity getting out from the west coast—Southern California—to the east coast with two little ones.

AUGUSTINE: It was very difficult. [I had] taken a pay cut to work for the government. We arrived in November, so winter was coming on. It turned out it was a tough winter. Going to work for the government, they don't fly you to look for a house before you take the job. [. . .] We didn't have enough money built up yet for me to fly to [take a preliminary trip] to the east coast and find a house. We had a friend find a house [. . .] that they thought we would like, [. . .] so I signed the rental agreement sight unseen. Anyway, the four of us [arrived] in [Washington] in the house out in the woods of McLean, [Virginia]. It was a wooded area at that time. There were horses [around] the place which our friend thought we would like. The house was old. [. . .] The guy who owned it [used it as] his getaway home from Washington in the olden days! [He'd] spend weekends at this house they had [in] McLean. Of course, McLean today is a suburb of Washington; it's part of it. Anyway, we [. . .] got through the winter, which was terrible. We were sick all the time. Everybody had colds. [. . .] Terrible winter storms. Come spring, we were robbed one day. Whoever broke into the house tore the place [apart . . . tore the door frame out of the wall. I had actually strengthened] it to make it hard to get in because I'd been worried [about the isolation]. Anyway, we immediately said, "We have to get out of here," because if you could do that, no way we can have the two little children here [. . .].

Fortunately, I was able to work an arrangement to get out of the lease and we moved into an area with lots of children, lots of people. But yes, it was [. . .] a tough year. On the other hand, the work was fascinating. And by now, unfortunately, the Vietnam War broke out. I was there '65 to '70, which was, kind of, the height of the [war]. Each Tuesday morning you would go to the Secretary's intelligence briefing where they'd tell us how the world was going. It was a different world. [. . .] Secretary McNamara had a management style that I didn't particularly agree with, but he had done very well. [. . .] I would characterize [it] as creating—what's the word?—conflict is probably too strong—but competitiveness between people in organizations so that if you made a mistake, you knew somebody was going to point it out very publicly. It

was that kind of environment, [but it did make you pay attention to what you were doing. There] was a department, the Defense Research and Engineering crowd that I was with, and then there was the Systems Analysis crowd that were known as the Whiz Kids. We fought . . . the war in Vietnam must have been mild compared to the war that went on in the Pentagon. It was a constant "gotcha" [. . .] we took different views on everything. [. . .] Ironically, somehow I made a lot of friends with the people in Systems Analysis. I seemed to be one of the few people to get along with them. As a result, I became kind of a conduit. I have friends today [whom] I worked with in Systems Analysis that really was viewed as kind of the enemy. It was [nonetheless] a wonderful [. . .] experience. I learned a lot. I was learning about major issues, new fields, but it was [an] antagonistic environment [and, worst of all, a war was] going on, and people dying. **<T: 120 min>**

CARUSO: So I didn't think to ask at the time, but when you were at undergraduate, graduate school and you were working on projects, your professors were working on military projects. Did you have to go through security clearance in graduate school, or did you have to go through it at Douglas Aircraft with the things that you were working on?

AUGUSTINE: [. . .] I didn't have to do [it] with graduate school because I was doing fundamental research, but the condition of my job at Douglas and elsewhere [was to have] a clearance. There are various levels, of course. My clearance level demands kept going up. When I was working in the Defense Department—the period you're describing—[the head of administration] in the Office of the Secretary of Defense was a three-star general, Air Force. One day he stopped by my office, and [. . .] said," You know, we noticed your wife's not a citizen. It would sure be nice if she were." I said, "Well, she would love to be, but it takes a lot of time." He said, "Well, we'll see what we can do." Anyway, Meg [was soon sworn in as a citizen]. They had a nice ceremony at the courthouse in Alexandria, [Virginia]. And my boss threw a big party that night for my wife. [. . .] She is the most avid American citizen today that you would ever find. She took the exam. She studied. They asked her the first question, "Who is the oldest person [in the] House of Representatives?" She named [him] like that! They said, "[You] pass." She was disappointed because she wanted to show off her knowledge. [laughter]

CARUSO: So you'd mentioned that a part of the reason that or part of the way that you made your way over to the Office of the Secretary of Defense was [because of] your experience with writing proposals and you thought that the good ones weren't getting funded, the bad ones were getting funded and so you wanted to learn more about what made a good proposal and what made a bad proposal. When you were in the Office of the Secretary of Defense, is that what you were doing for your main role, that you were assessing proposals coming in for funding and then determining who was going to receive it, or were you doing something else?

AUGUSTINE: [It] turned out that wasn't what I was doing at all. I don't think I ever evaluated a proposal in the five years I was there! [. . .] I worked in the [Strategic Defense] Office of

Defense Research and Engineering in which . . . my particular role was ballistic missile defense largely [. . .] and all three services were working in that area at that time, but mainly the Army. Also, I got involved in some strategic space programs that were part of our [charter]. I had a little group of programs I was responsible for in budgeting and calling [to] the Secretary's attention if something wasn't going right or something needed to be done. When I was at Douglas, I knew of this group and how much power DDR&E seemed to have. I remember asking the marketing guy who told me that they would probably offer me a job, ["How many people work in the Strategic Defense group of DDR&E?"] I'd figured he'd say 120 or something like that. He said, "Well, there's Charlie, and there's Ron . . ." I think there were five [. . .] or six of us. For a guy who was—I don't know—thirty years old or something like that, it was a huge learning experience—heavy duty—and there were consequences because there was a war going on. [. . .] I, sort of, got into the systems world doing systems analysis myself [in order to] hold my own with [the] people in the Systems Analysis group.

[. . .] I had the good fortune—[ringing noise] that's my fax. **<T: 125 min>** I'm sorry. One of the fortunate things [was that] in high school I had taken a course in journalism, and I learned more about writing from that course [than any] courses I've taken in English and the likes. I'm a fairly decent writer, and that gave me a chance to write documents for the [Secretary]. Until McNamara got there, there really wasn't much of a system for managing; he really put in the system. I give him great credit for that. One little piece of that system was how do you decide what to fund in research and development. One Friday night, he had to make a decision the following Monday and I was given the job to write a paper with the various options and the background so he could read the paper and make [a] decision. [The paper] was to be no more than twenty pages long, double-spaced, and it was to present [all] sides of the issue in a very balanced manner. And so I did that. McNamara really liked it, so that became for his [mechanism for] managing research and development. Pretty soon everybody was writing these papers [twenty-four hours a day]. They all hated me! [. . .]

Anyway, we wrote lots of those papers, and I was involved in providing background papers for the Secretary to use to make decisions on a lot of the systems that are in being today. [. . .] That seemed to work out well. [. . .] I was in the strategic office—main focus on Russia. An opening came up at the next level up in the organization in the tactical systems office that dealt with tactical [systems] . . . close air support aircraft, things of that type, tanks, trucks, rifles—stuff I knew nothing about. I'm an aeronautical engineer. Anyway, my boss went to bat for me and they asked me to take that job. It was a promotion, but that immersed me suddenly into the Vietnam War. I became responsible for the [oversight of the] development of many of the tactical systems that would be used, and I wound up spending a [brief] time in Vietnam—as a civilian, of course [. . .].

CARUSO: I'm wondering, so you're taking a military job at a time where I think and I know there's a lot that comes later with the Vietnam War, but you're taking a military job at a time where I think America is starting to question the—I don't know if reasoning is the right word—but is possibly starting to question the Cold War itself and the investments in military spending, ideas of or the roles of nuclear weapons. Part of the reason why I'm asking these questions is

because I know *Dr. Strangelove*, for example, Stanley Kubrick's movie came out in '64, and that's really a criticism of the military establishment.[1] What was it like working at a period of time when the American public wasn't necessarily completely supportive of military, military decisions, military environments, Cold War and things like that?

AUGUSTINE: Absolutely. It was not infrequent that there would be demonstrations on the steps of the Pentagon or the main concourse inside the Pentagon. Truly, the Pentagon was not a secure building—[anyone] could walk through it and walk into the individual offices, except for a few that were down underground that were highly secured. [My] wife could come and see me in my office. We were in charge of controlling our documents. It wasn't the world it is today. **<T: 130 min>** You could actually drive your car through the tunnel under the Pentagon and actually park down there right [under] the concourse. There were [stores in the concourse that] the public could come into. Different world. The Vietnam War was becoming very unpopular, and a lot of the people I was working with were military. They were told to go fight there, which they did; some of them died. It was hard. The public didn't separate the decisions made by national leadership and the role the military played. They blamed our soldiers for the war in Vietnam, and [when our soldiers came] back, they'd be mistreated. I can tell stories of personal friends who were mistreated because they had served in the military. Incidentally, it was a draft at that time, [so most] hadn't volunteered to serve in the military; they were told you will serve in the military, you will go to Vietnam, and here's your rifle. Whether or not one agreed with the war, [. . .] you could make arguments on both sides.

I'll try to make the argument McNamara [might] have made. Unfortunately, unlike today where we somehow have been able to separate wars that are not all that popular—Afghanistan, [. . .] the second war [in Iraq] and so on—from [respect for] our military. Our military today is held in very high regard and [that may have interesting reasons. At] the time the Vietnam War started, I remember seeing maps, and helping make some of them, where it would show the part of the world that was controlled by the communists—in 1945, and then [in] 1950, 1955 and '60, '65—the map [kept getting more] red and the attitude was [that] somewhere we've got to stop [it, we have] to draw a line. At this point, the communists had taken over Cambodia, Laos, North Vietnam; [the view was that if you have to draw the line somewhere, Vietnam was] where it was drawn. Another question comes up. I spent a good part of my career doing military things and space things. The military things—would it have been [nicer to spend much of] your career on something other than [warfare? The] answer has to be, yes. I wish we didn't need a military. But I'm absolutely convinced we need a military, and if we do [. . .] we owe the people in it the best equipment we [can give them]. I felt comfortable going to work every day, but it was a difficult time, no question.

Dave [David] Packard became Deputy Secretary of Defense; Dave [created] Hewlett-Packard, founded it, was one of the best executives I've ever worked for. Melvin [R.] Laird was Secretary, [. . .] a great secretary. They were [a superb] combination. [. . .] Dave was a guy who

[1] *Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb*, directed by Stanley Kubrick (Columbia Pictures, 1964), 94 min.

if you came in with an analysis of a situation . . . . I'll give an example. He wanted you to have looked at [the problem] firsthand. I went in with an analysis of something [that] wasn't working very well in Vietnam—some equipment. Dave said, "Well, have you been over there to see it [in action]?" I said no. The next thing I know I'm in Vietnam [in] an Army uniform. No insignia, no rank, no nothing, [only] my name—last name. The good guys didn't know whether they should salute me or not, and the bad guys didn't know whether they . . . I guess they knew they should shoot me! I spent just a brief period there in which it was obvious I was a civilian, out of place, and moderately senior. [When] we landed they had assigned a young captain to keep me alive, I guess, keep me out of trouble, and we landed in the middle of night, got in a helicopter, landed somewhere. The grass was about three feet high. As we <**T: 135 min**> were getting ready to [jump out] . . . the helicopter was hovering a couple feet off the ground, the captain, as he jumped out, [yelled], "Watch where you land." It was dark, and the grass is three feet high, and the wind from the helicopter, [downdraft. I yelled], "What [am I watching for?" "Snakes] and mines." That was my introduction. I thought this is not going to be a good experience. But I have a great deal of admiration for [our] people who [fought] there and did what their country asked them to do. But it was a hard time.

CARUSO: So I had introduced . . . . I asked my question about reactions to the American public and feelings about the war just after you said that you were being shifted into or moving up a level in terms of positions at the . . . in the secretary . . . in the Office of the Secretary of Defense. So, I'm sorry for that interruption, so if you want to tell me a little bit more about that shift in positions, I'd love to hear that. I also have one other question. You'd mentioned that when you were at Douglas Aircraft Company, you . . . you know, that's when you first mentioned your interest in woodworking and woodshops, and you, kind of, missed doing some of that research, that testing, the models. I'm assuming that when you were in the Office of the Secretary of Defense, you weren't going home at night building models to test things. And I was wondering how you felt not having that as part of your position in the office. So those sort of two things to turn back to you.

AUGUSTINE: Let me back up a little. When I was at Douglas, my wife and I rented a little apartment in Santa Monica, [California]. We didn't have any furniture, so I set out to build furniture. I signed up at the local high school—they had a great workshop in this high school—and so I signed up to [take a woodworking course] there. Very quickly, the teacher [. . .] saw I had some experience [and said], "Look, if you want to just come in [at] night and work in the shop, you don't have to go to classes or do anything." So I built [some of] our furniture—a bunch of it—while I was in the workshop. [And] you're quite right, I didn't get to do any of that during the years at the Pentagon and I missed it a lot. I [also] love to read. [But] I did very little reading for fun. [Just no] time. At work, I had a new boss. Another great boss. I've had great bosses in my life—direct bosses, immediate supervisors—and he was a person to tell you generally what he wanted and leave you alone and let you [. . .] do it. It was also kind of awkward in the sense that the people who worked for me were all older . . . in my second job in the Pentagon, they were all older than I [. . .]. One was a very senior Navy captain. One was an Air Force colonel who rose to three stars. It was an interesting group. [. . .] Something we've

lost today in our government [is people with expertise and experience serving in government for a few years to bring fresh ideas, management perspectives and the likes].

Back in those days, if you were asked to take a position in the government—particularly in Defense—you didn't turn it down; it was your duty to do this kind of thing. I [can] remember how proud I was to be a public servant, a civil servant. That time I thought what finer thing is there in the world than to say I serve the public; I'm a servant of the public. That's the enthusiasm I went into the job with. Our little group where I was working, I guess there were a [half-dozen] of us [at this point, a senior officer from each of the military services—military uniformed, active duty—a third of us were civilian career civil servants, General Schedule (GS) scale, and about a third of us were people like myself who would agree to stay two years or so]—I wound up staying five. **<T: 140 min>** I agreed to come and work for the government for a few years and then leave and go back to the private sector. Today it's very hard to do the latter because of conflict-of-interest concerns. I must say, hardly ever—maybe once—I saw some case of a conflict of interest of a person coming from the private sector to the government, [particularly in Defense]. People [. . .] knew where you were from; people were watching you. I think by and large, the people I worked with were genuinely there to contribute, and by having these people with three very different backgrounds, you had the continuity of history, you had the hands-on military [. . .], and you had people coming in from the outside with a new perspective [and] fresh ideas. It was great mix—good lesson for managing.

CARUSO: And so what were your overall responsibilities in that new position?

AUGUSTINE: They were a little like the previous position, except [with a broader portfolio, one level higher]. I now had people [work for me] doing what I used to do. I was overseeing what they did, and the job was to decide on behalf of the Secretary of Defense's office what systems should be funded, how much, what systems should be started, what ones should be stopped. We had very little to do with "who" was selected [. . .]—like a company [. . .]—to build a system or [anything] like that. It was [a] role of [policy, budgeting, monitoring, and what] integrating the services proposed.

CARUSO: So I'm trying to be mindful of the time I know we're approaching the end of the time for today. I know that you wind up leaving you said that after five years and you go to LTV Missiles in Space Company. I don't know how much you have to say about . . . maybe I should start there. How . . . at what point did you decide, or was it decided for you that you were going to be leaving the Office of the Secretary of Defense?

AUGUSTINE: When I left college I really wanted to work in industry and build things, apply things, so when I took the job in the government I agreed to stay two years. I viewed it strictly as a brief stop [in whatever my] career might turn out to be. So when I [had] put in—as I said—it turned out [to be] five years, when the five years came up, I really wanted to go back to

industry and do something different. I also noticed that some very talented people in the government that put together the budget year after year got very stale, and I didn't want that to happen [to me. Once it was public that I was leaving I began getting job offers]. It was, again, people with technical backgrounds [who] were in demand. So I—trying to think—at that point, LTV Corporation was [. . .] maybe the tenth largest company in the [. . .] country or something like that. It was started by a fellow by the name of Jimmy [James] Ling, who at the end of World War II bought [. . .] a bunch of copper wire that was excess and sold stock in his copper company at the Texas State Fair and built a company. [. . .] I think [LTV] owned 126 other companies, if I remember right, [. . .] a giant conglomerate. It was one of the first giant conglomerates. They had an aerospace company; it was in Dallas, [Texas]. Anyway, we thought Dallas would be a decent place to live for the children. Also, we weren't too thrilled about having the kids grow up living [near] the beach in California. [When we were there, we] were living not too far from the beach. It sounded like a good time to leave. [One] hot July day **<T: 145 min>** [. . .] I went to work at LTV, and [we] bought a home in Arlington, Texas, which turned out to be just a wonderful place to raise a family. I guess I should say that LTV, being a conglomerate, pretty much [let] the aerospace company [. . .] run its own affairs. Conglomerates soon came out of favor, and LTV—well, I'm getting way ahead of the story—but eventually many, many years later went into bankruptcy. From the very top to the very bottom. [. . .] I guess I was building reputation of going to companies that got bought by somebody else or went broke. It's a wonder anybody would hire me! The job was a good job, and [. . .] Arlington was a great place to raise children.

CARUSO: I guess your reputation is that if you leave the company, then it's going to get bought, right? So they should do everything to keep you around so that way someone else doesn't . . .

AUGUSTINE: In all these years, I never thought of that rationalization. That is really good. [laughter]

CARUSO: So I do want to spend some time talking about your time at LTV but I know we only have a few minutes left, so I'm going to leave it up to you. Do you want to spend a few minutes talking about LTV, or do you want to wrap it up for today and then pick it up next time?

AUGUSTINE: Let me look at my calendar and see what's happening here.

CARUSO: Sure. Kenny, do you want to pause it?

EVANS: Okay, great. Okay, so you were talking about your time at LTV, and I was wondering if you wanted to, kind of, pick up where you left off about talking about the work you were doing there and your life in Dallas and Arlington?

AUGUSTINE: Arlington was a fairly small town at that time—halfway between Dallas and Fort Worth—and the work that I was doing was in the missiles and space group where I was in charge of the advanced programs and marketing. [This] was, kind of, collecting new business, and the advanced programs meant if we were building a prototype of something. [. . .] I was not involved in production in any way, manufacturing—[my part] was more the front end of the business. The group I had was modest size—[. . .] almost all engineers. We were bidding on [. . .] a cruise missile during that period of time. The fellow that I worked for had just joined [the] company; he'd [. . .] been a—I think—vice president of [IBM. LTV] was run by [W.] Paul Thayer, who was a fighter pilot—an ace in the Korean War—later became Deputy Secretary of Defense. The work was very interesting and very technically oriented, which I liked. A lot of systems work— systems engineering. It appealed to me. And I guess I always enjoyed tying pieces together [from] different fields.

EVANS: And so at that time, that was around 1970 that you moved?

AUGUSTINE: Seventy to '73, it would have been.

EVANS: And so around this time here, your kids were—let's see—five-and seven-ish. They were in . . . starting grade school?

AUGUSTINE: Let's see. [. . .] I remember when we moved to Texas, [my wife carrying a plastic bag in her purse on the airplane] with the kids' goldfish in it because they wouldn't leave the goldfish in Washington! <**T: 150 min**> I [think] that would [be] a shock to some security checker [of] today. They didn't have security checks in those days.

EVANS: You'd probably have to buy it a seat.

AUGUSTINE: [That's] right. [. . .] The kids [were in school—grade school—quite] near to our house, close enough so that they could walk to school. Oh, we added a Labrador retriever and were pretty much settled into the home life. One of the challenges, of course, is always how [you balance home life with work life, but] Texas was a very family-oriented place—a lot to do. I became a [Dallas] Cowboy fan, which, having been a [Washington] Redskins fan [for years], was quite a switch. I remember going [. . .] with the management club to the first game watching [the] Cowboys play, and they insisted I wear a hat with [a] feather in it to symbolize

being the only Redskin person in the [stadium]. Today we're known as the Washington Football Team.

EVANS: Yeah, it sounds . . . you know, growing up, I was just hated the . . . so I'm from Arlington, Virginia, and just every Cowboys fan was my mortal enemy. So, I imagine you were very brave to take on that role.

AUGUSTINE: [Like] a number of stories, I'm getting way off the subject here, but one occasion [. . .] was at the president's prayer breakfast here in Washington, and there [were] many, many tables. At the table we were at there were about eight or nine people. My wife, who knows nothing about football (having come from Sweden), was seated by somebody she didn't know. When he introduced himself, she didn't register the name of John Riggins, who at that very time was of course the most famous person in Washington, slightly more so than the President—running back for the then Redskins. John asked her . . . let's see. I'm on another step into Washington here. [She] asked John, "What do you do?" And he said, "I'm an athlete." I guess he decided to play along. "Oh really," she said, "I like tennis. What's your favorite sport?" He said, "I, kind of, like football." She [responded, "Oh really? My] favorite team's the Cowboys. What's your favorite team?" By now, everybody at the table, including myself, [was] in hysterics. [laughter] But Dallas was a good place to live. It was a good choice.

Unfortunately, it was again one of the [management's] decisions that I didn't particularly [agree with]. Our part of the company had bid for the first phase of the cruise missile [. . .]—and we were clearly the underdog. But we won one of the two final contracts [for] a run-off to build the [. . .] missile for the Air Force. [. . .] It was a <u>huge</u> win for us. The management [. . .] I suspect . . . . I can understand their point of view—decided that it was too big [an opportunity for the Missiles and Space] division I was in and [they moved] it to the aircraft division. That meant all the people I worked with who worked like [dogs to win] were cut out. [The program moved] to the aircraft division and they wound up losing [. . .] the shoot-out—the competition. That was, I guess, one of those [tough], very tough management decisions I probably didn't agree with but management makes tough decisions. [. . .] I worked on a lot of other stuff, enjoyed it—a lot electronics—all applied, no research there.

EVANS: But you were . . . so one of the threads that I was listening to you talk with Dave about was this being able to build things get your hands dirty. Were you able to, kind of, fulfill that itch, you know, scratch that itch while you were at that company, or was it more of a management type of position?

AUGUSTINE: I was getting to the point where it was mostly management, [but] I was able to get involved in engineering analysis. **<T: 155 min>** I guess you'd call it systems design, systems engineering, systems architecture. At that point, software wasn't as big a deal as it is today, but it was beginning to show up. I was beginning to learn a little about that, and I'd

become very interested in radar, so I read all the books on radar that I could lay my hands on. [. . .] I'd had a lot of electronics when I was in college, [so] I was pretty well-suited to cut across those various kinds of fields. They were doing some work in space there; it was still pretty. . . at that time—let's see—'70 to '73 would have been right after—am I getting this right?—yeah, right after Buzz [Aldrin] and Neil [Armstrong] had landed on the moon. Because of my work, I got to know them very well [. . .]. LTV [had a factory where] they were building things, and I loved to walk out on the factory [floor] and in the test labs and so on, but I guess [. . .], as my engineering friends say, I descended into management!

EVANS: Was there a point . . . . I'm wondering in your transition back from moving out of the Pentagon back into the private sector. Were there things you missed about working in that environment? I know you had said it was quite competitive, and at times combative, that you were fighting battles. Did you miss that environment or was that . . . did you find a similar type of culture back in the private sector? Were there things you took with you from your experience [. . .] from the Pentagon back to the private sector?

AUGUSTINE: The workplace tone was somewhat different in the sense that you didn't have this fierce [partisanship; we were] all kind of in the same boat trying to make it float. Most people have a tough time leaving a job in the [government] and going back to [industry. I remember] the first day I came home from work, [my wife asked], "How did it go?" I'd been working in the Pentagon where the round off was a hundred million dollars, and, now I'm in industry and I spent all day saving the company forty thousand dollars. You have to recalibrate what's important [in] your own bailiwick. [In the private sector you're] dealing with issues that are not global issues; they're not world-impacting; they're not dealing with [billions] of dollars. But they're very important to your responsibilities, [so] the shift was very easy for me. I had worked very hard at the Pentagon [and I] continued to work very hard. Probably the hardest I've ever worked in my life was when I was a public servant. I used to comment [about] that to some my board members later in my career and they didn't particularly like that, [. . .] thinking I should have been working harder for them than [at] any time! [. . .] It was just a different level of challenges. I think the main [things I gained] . . . two things from the Pentagon: one was dealing with broad systems as opposed to a component in the system, or a single missile or a single rocket [that was] part of a huge system. That appealed to me, and I learned a lot [. . .] from it.

And I also got a very useful understanding of what drives our government and the challenges it faces. [Most of the people I know in] industry who had lost [a] competition for a new system, it was always because the government "cheated" and they didn't do [the evaluation] right, they didn't do the analysis. [People] in the government's attitude is [too often that] people in industry, all they care about is making money. Neither are true, **<T: 160 min>** and it helped me a lot to get an understanding that government people have a lot of constraints on them [that they] don't have in industry. That causes [people in government] to move more slowly, more cautiously, more deliberately; it frustrates people in industry, but there's a reason for it. And similarly, I came to learn that people in industry—particularly in the defense

industry—are very dedicated to providing good equipment to our soldiers, our sailors, our airmen, and our marines. [But] that the people in industry [. . .] still have shareholders that they have to worry about. It gave me a whole new respect for how you [must] make the system work together, with people [from industry and from government having] very different sets of constraints.

EVANS: So you spent, I guess three years then at LTV. Is that correct?

AUGUSTINE: That's right.

EVANS: Was there something . . . you'd mentioned earlier too this kind of sense of duty and your, kind of, pride that you took in being a public servant. Is that part of what led you back into government service?

AUGUSTINE: I really hadn't planned to go back [into] the government. With the children in [. . .] school, I didn't think it was a great thing to be doing. And we were very happy [in] Texas. My wife loved it there. [We] had a lot of friends. It was a welcoming environment, and I think we basically had no plans of going back to government; we were pretty much settled. [. . .] That was going to be it for us. I guess you could say, "What happened?" [Well], I'd been there about three years, minding my own business. The corporation wasn't doing that well. The company that I was part of [. . .] was doing okay. The corporation [did everything from airplanes], airlines to car rentals and ski resorts to [. . .] steel companies. It was struggling; as were a lot of conglomerates at that point, but [our piece was] doing okay, and I liked the people I worked with. So, there was really no reason to make a change.

Well, I was sitting at my desk one evening after hours, and I get a phone call from the [. . .] special assistant to the [Secretary of Defense and he] said . . . let's see . . . at this time, [Richard M.] Nixon was in office and Watergate was . . . [let me get] my story straight here: Nixon was in office, and Watergate was [. . .] bubbling. Anyway, I get the phone call, and he said they were looking for somebody to come back to Washington and be Assistant Secretary of the Air Force for Research and Development and [would I consider the job]; would I be kind enough to come back to Washington and talk to people there about doing it. I said, "[There's] no way I could do that. My family's here. I've got [job responsibilities] I've taken on for the company. And for the first time in my life [I'm making a little money. There's] just no way." The person I was talking with said, "Well, you probably know a lot of people who would be good candidates [for the job]. Would you consider coming back to Washington and talk to us and maybe you could suggest some other good candidates?" [How] do you say no to that? So I said, okay. And they said, "Well, this whole . . . this discussion is extremely confidential that we're having because the Congress doesn't like for leaks to get out [about] who's going to be the . . . the White House doesn't like leaks [about] who's going to be nominated for what [job

before Congress is notified. This discussion is] very confidential, so make your own airline reservations and so on." I said, "Sure, I'll do it."

I get home that night, and as I'm going in the front door, I'm thinking how am I [ever] going to tell my wife that I've even agreed to go Washington and talk to them, because she loves Dallas and Arlington, and the kids are in school and . . . wrong everything. How am I going to tell [her]? So I come in the front door and <**T: 165 min**> she [says], "The strangest thing happened today." I [asked], "What was that?" She said, "A realtor from Dallas called and wanted to list our house because he understood we were moving to Washington." That's how the system leaks.

[. . .] I was in the back of my foxhole right away! Anyway, I did go [and talk] to them. They asked if I would . . . they wanted me to visit with Jim [James R.] Schlesinger who'd just become [Secretary of Defense]. I went into Jim's office to talk to him; I didn't know him. We talked for a little bit, and he said, "How . . . would you rank [. . .] at . . . this point in time how you would rank the quality of the [managements] of the three services in research and development?" [. . .] I said, "Well, the Navy's probably the best and the [. . .] Air Force pretty close behind, and the Army's the worst." [He immediately] looked at me and said, "Do I have the job for you. [. . .] I want you to go talk to Bo [Howard H.] Callaway," [who had just] been appointed Secretary of the Army. So I went to Bo's office and said, "Look, I'm here under false pretenses. There's no way I can do this kind of thing. I'm an aeronautical engineer, aerospace engineer." Bo is one of the most convincing people in the world and totally dedicated. [. . .] The Vietnam War is still grinding on, and Bo said, "I really need you. Will you join the team? [I've] built a great team." [. . .] Bo was so committed and dedicated and such an honest person; I was so struck by that. [. . .] I said, "I'll go talk [with] my wife."

Anyway, it was a very painful decision for her and for me. Fortunately, the kids were small enough at that point that their life was built around [our family], not a location, not even a school—[to some degree—so] it was easier than later moving kids. So we decided we'd make the move, [. . .] we went back to Washington. I took another big pay cut and I [accepted the job as] the Assistant Secretary of the Army for Research and Development. I had to go through [. . .] a congressional hearing, a confirmation hearing, so I lived at the Army [and] Navy club for a week or two while I waited to get the hearing. And because of conflict-of-interest issues, I had to leave the company immediately, which I did. [. . .] I was, sort of, unemployed for a couple [of] weeks while I waited for a hearing. [Eventually] I had my hearing.

I probably [elaborate too much], so please tell me. I knew nothing about politics. I [hadn't even met] my own congressman. So here I'm going to have to go to a hearing. I've never been to a congressional hearing; I didn't even know what they did. [. . .] I was given by the Army a book about . . . so thick with questions and answers that [I] might get asked [and] that I ought to be ready to deal with. [. . .] I show up at the hearing, and you sit at a little table. The members of the Congress all sit in chairs [way up above you]; you're pretty minimized in your position here! [I also happen] to remember there was a matchbook laying [at] my place on the table and the cover on the matchbook said, "You could be making more [money as the]

electrician." That's always stuck in my mind. I don't know if [it] was somebody's idea of a joke, or what.

The hearing started, and most of the members of the Armed Services Committee were from the South, which was where most of military bases were [. . .] also at that time. With the Cold War going on and Vietnam, to be on the Armed Services Committee was a **<T: 170 min>** [prime] job in the Congress**.** [The] jobs were assigned, I guess, largely by seniority, [so most of the people up there—senators—were from the South]. The chairman [John C. Stennis], if I remember, was . . . oh my goodness, [how] could I ever forget it? [The well]-known senator at the time, who happened to have been the father of a classmate of mine at Princeton. [. . .] I didn't know the classmate very well, or the father at all. He didn't know me from Adam. [When] the hearing began he hit the gavel and [. . .] peered down through his glasses and said, "Mr. Augustine, I wonder if you would share with us your views on the War of the [Northern Incursion]." I figured [that what I said] in the next minute [was] going to determine the future of my career, and all the Southern senators up there [were looking down at me]. I thought for a minute [and] said, "Well, Mr. Chairman, I'm from Colorado, and frankly, we didn't have much to do with that." He looked to his left and everybody was nodding; he looked to his right and they [too] were nodding. He said, "I guess that will be all right." Then I was asked a few perfunctory questions, [and that was it]. In those days, [that was] a confirmation hearing at that level of government. Pretty much [a done deal; friendly].

I [. . .] went to work in the Pentagon the following Monday and on the way [into the Pentagon a] federal marshal comes up to me and says, "Are you Secretary Augustine?" [I had to think a moment and finally] said, "Yes, I am." He [responded], "Well, I have a subpoena, I think it [is] for you." "What's that?" [I asked]. He said it has to do with such and such an Army program that some citizen is suing and you're [the assistant secretary] so they are suing you. I didn't know anything about [it]. So I get to my office, I have an executive officer—[a] wonderful man, soldier. [. . .] I said, "I came in here and I've been given a subpoena [already]. He said, "Oh, they must have a new federal marshal down there. They're supposed to not bother you with those; they're supposed to [. . .] just deliver them in the mailroom; [. . .] we've arranged that. I said, "Well, do you mean I get more than one of these?" He said, "Oh, you'll get several a day." [. . .] I thought, "What kind of job have I gotten myself into?" [Colonel John Todd] said, "Don't worry. The Justice Department will defend you. You don't have to do anything." [That] was my introduction.

I worked for the [Secretary of the Army], and as I mentioned earlier, the war is going on and anybody in town can walk into our office. There's no security. There had been, I guess, at some point, but many, many years ago. [Anyway], there was no security. It was quite a strange thing. I had a very small staff—I think maybe [seven or] eight people. Most of them [were] uniformed military from the various branches of the Army, [and] two secretaries. [That] is a lesson I learned in life: [. . .] have two secretaries so you can stagger the hours they work, and my military assistant, [John Todd], was a colonel in the Army—aviator—highly qualified, fine man. I was working [with] good people; Bo Calloway was a great boss—very positive person. It was a privilege to be there.

EVANS: So at that point were you planning to stay in Washington? Did you think you were going to continue to serve the public and work in the Pentagon, or did you . . . was it a job that you liked and wanted to continue doing?

AUGUSTINE: No, [I] was a political appointee, a presidential appointee. So you were there as long as the president **<T: 175 min>** wanted you—nominally four years or as long as [the] administration stayed. [The] most I would have stayed would have been four years, and that was, kind of, the understanding at the beginning. [At] my level almost nobody would get asked to stay over [if a different party took the presidency]. One of the nice things I liked in the engineering world [was a lack of partisanship]. I was in research and development—highly nonpolitical; the Pentagon was [also] highly nonpolitical in those days, believe it or not. Particularly under Mel Laird [Melvin R. Laird]; Mel kept the politics away from the Pentagon. You did your job for the military and for national security. Occasionally, somebody might try to put a little pressure on you from outside [the] Pentagon—from the Congress or the public or . . . But within the Pentagon, it was really nonpolitical. We tried to do the best job we could do, and I was with a very capable group of people, very hard working, honorable folks—a great place to work. It was a bad place to work in [the] sense there's a war going on, and my office window looked [. . .] on Arlington Cemetery, [where] every morning I'd look out and they'd be digging new [graves. When you flew on] a military aircraft out of Andrews Air Force Base, they'd be bringing in medevacs for soldiers, sailors, airmen, marines to go to Walter Reid [Army Medical Center] or Bethesda [Naval Hospital], or what have you. [It] was the real world. There were demonstrations [. . .] going on. Typically, a demonstration would involve anywhere from three to ten people and about twenty [newspaper reporters] and television cameras. They were all peaceful; just people who didn't agree [with our national involvement in Vietnam].

EVANS: So this job you are . . . at one point you were undersecretary for the Army, was it then your term ended or Nixon resigned and that's when your job, kind of . . . you start to transition out of the Pentagon?

AUGUSTINE: Backing up just a little bit, I had been assistant secretary for probably two years. The person who was the undersecretary at the time was having [. . .] problems—management problems, frankly—and he left. The Secretary of the Army and the Secretary of Defense asked if I would become the Undersecretary of the Army, which cuts across everything [relating to the Army], the number two civilian in the Army, and when the Secretary's away, you act as the secretary. It's a role that I would never . . . . I'm an engineer. [I did] a little management in my life. I was [ultimately] vice president at LTV. It was an enormous responsibility. Anyway, I went to the confirmation hearing and was confirmed. So now, I had, kind of, an interesting situation. [. . .] Right after [this] the Secretary of the Army left to take a position working directly for—I'm a little ahead here—but the Secretary left to take a position [heading President [Gerald R.] Ford's campaign], and so I became the Acting Secretary of the Army. At this point, I'm Acting Secretary of the Army, I'm Undersecretary of the Army, and

they haven't [yet] replaced me as [Assistant Secretary for Research and Development. The] good news was we made decisions very quickly! Instead of coordinating through three levels, [I] would have one meeting and boom, the decision was made. You just hoped you got it right. [. . .] I served as Undersecretary for a few years, and then the Nixon troubles blew up. I hope I'm getting my sequence [. . .] right. <**T: 180 min**> Anyway, I remember standing at [a] window watching Nixon's helicopter leave when he resigned. The Pentagon basically stayed out of that. I give Mel Laird the credit for that. The [main impact on us was that] we got a memo saying "the new chain of command is . . ." [. . .] It was no longer Nixon; it was now Ford.

At least from where I was sitting, which was [at] a fairly high level at that point in time, life went on every day. I guess the military is used to losing people for one reason or another, and "the next man up" [prevailed. The] Pentagon continued to do its job. The following day, after Nixon left, [the presidentially confirmed appointees] were all called to a meeting in the East Room at the White House. [At] that time there were quite a few, but nowhere near the number there are today—not even close—[and] President Ford said that he would like "most" of us to stay on and [. . .] not to bail out on him—please stay. I had no reason to [leave]; as far as I was concerned, my job hadn't changed. So I continued [. . .] for a while as Acting Secretary. Then as Undersecretary for the rest of my term. Then the four years came up, and President Ford's term came to an end. By now, I was planning to leave anyway. Finding a job [. . .] if you're an engineer and work in aerospace—you're an aeronautical engineer—most anything you're going to do is going to have to do with the Pentagon. So I had to be extremely careful with what I did in the way of a job and so on. [I], of course, got the general counsel [involved], and said I'm thinking of leaving and so on; I'm talking to these three companies, or whatever it was.

One company that was not on my list was Martin Marietta. [. . .] I'd decided on [another company I would work for]. I was in a meeting in my office [and] I get a telephone call from the CEO of Martin Marietta [who says], "We understand you're thinking of leaving, and you haven't talked with us." I said, "No, I've worked with your company some [in my Pentagon job], and I think I've got a conflict of interest." [. . .] He said, "Well, I don't think that's true, but if that's the way it is, okay." So I went back to the meeting I was having. [The] Defense Department's [General Counsel] happened to be at the meeting, which [was] uncommon. After the meeting, he came [to me and said], "I couldn't help but overhear your conversation. Maybe you don't want to work for [whoever that was], but you can work for them. You just can't work on anything that has anything to do with your job here in the Pentagon." [. . .] I said, "Oh really?" Anyway, [I called the CEO of the] company back, and said I was going to take another job tomorrow, but I'm told I can talk [with you]. The understanding is that for a few years—or permanently—I [can] have nothing to do with anything I worked on in the Pentagon. [That] may make you not [. . .] interested in me. Secondly, just my own criteria, I would not want to have to do anything on behalf of the company [requiring] any contact with the government for [a couple of] years. He said, "No problem." Anyway, I wound up going to work for that company totally by chance once again. [The] company [religiously] honored those conditions that the government and I imposed; there was never a problem.

One of the advantages of [working at Martin Marietta] was I didn't have to move the family. I didn't have to move our house. [We] could stay in the house that we lived in. [The company had] just moved their headquarters to Washington, so it was ideal for the kids; they were at the age now where you didn't like to move them from school [to school. That] was it. The Army had [had] a very hard time developing new systems; [. . .] they would start [. . .] something, get halfway through [. . .], it would develop a problem, which all [systems do, and then somebody would] come in with an idea for a new system that didn't have any problems. They'd cancel the one that was half-done, and start on the new one. **<T: 185 min>** It was a period of not producing [much of] anything—like a twenty-year period, twenty-five-year. [Just] before I got there—credit the person before me—the Army had picked five systems that really mattered to the future [capability of the Army], and those are the ones [I resolved] we were going to make [work. And they all had problems, incidentally—common in the] development phase. But my commitment to myself was [that] unless something was really, really wrong, my role there was going to be to try to get these things through the system and make them work. Most of these things—[tanks, helicopters, missiles, etc.]—would take years to develop and, even though we ran into problems, I tried to stick with it to be sure that we worked our way through the problems. I'm very proud that all five systems went in the inventory, and all five systems are really the main systems the Army is fighting with still today. It's time to get a new five systems, but our Army today fights with these same [basic] systems.

EVANS: That's incredible. So this is still . . . the systems were then developed in the seventies and are still employable?

AUGUSTINE: [They've all been upgraded]. I suppose you probably would hardly recognize them, [. . .] the aircraft all have new engines and they've got new electronics and so on. But they are the same name [and the same basic concept]. There was a tank, a fighting vehicle [. . .], an air defense missile, and two helicopters, and they're all out there today—main line. And as I say, they're all systems that had troubles. I can remember one morning—a Saturday morning—about five o'clock. I'd been asleep but the phone rings and it's Jim Schlesinger and he says, "When are you going to cancel that SAM-D . . . It was called SAM-D [Surface-to-Air Missile – Development], air defense missile. Turns out it's the [same Patriot system] that they use today. [. . .] I was half asleep. I said to Jim, "I've only [. . .] been here a short time. Give me sixty days; I'll dig into it, see if it's got a [fundamental problem and if we can put it] back on track. If not, we'll cancel." [The] group I worked with [. . .] really scrubbed it. We put it on a different [path], and it's turned out to be a great success. [It was a significant factor in] the outcome of the Mideast war a few years later. [. . .] The Patriot really is very successful system and is, I guess, [. . .] about to be deployed to Japan. [. . .] It was a successful tour, from my standpoint.

EVANS: I'm wondering, as you read, kind of, science policy history textbooks, there's often this discussion of Nixon that has his disdain for scientists and one point you know kicking out all members of PSAC before his second term. When you were in the . . . were you in the Pentagon, did you have . . . you said that the Pentagon maintained its, kind of, independence and

apolitical status. Was there . . . obviously there was pressure from the White House on various issues, I guess, a very general question, but were there instances, one where you interacted with these members of PSAC, or two with Nixon himself in terms of these battles over weaponry and [Nixon's] political agenda surrounding those during those times?

AUGUSTINE: [. . .] I had very, very little interaction with Nixon. He was a couple levels above me, but I did interact with PSAC quite a bit in those years. The Pentagon really was very apolitical. [During] Watergate, Mel [Laird] basically told us [. . .], "If somebody calls you and says 'the White House wants. . .' you tell them the White House is a building, and buildings don't want. [If] the president wants something, have him call me; but you stay out of [this." He] really kept us [. . .] insulated from . . . . The only thing I knew about Watergate was what I read in the newspapers. [Today], the military is trying to take that stand too. **<T: 190 min>** Difficult situation. But putting that aside, the PSAC—President's Science Advisory Committee—I first started working with [it] while I was working for McNamara and [then] Laird, way back in the first tour I had at the Pentagon. Candidly, the PSAC was difficult to work with. [To be very candid, its members] were deemed by many of the people I worked with as being somewhat arrogant. [They] would show up and tear apart everything we were doing. [It] may have been their stance on the war, [. . .] but the issues we dealt with were purely technical and they were—candidly—rather demeaning to the civil servants. I had a couple squabbles with the PSAC myself, [and I take pride that] in both cases I turned out to be right. [It took] years to prove that. But I took a considerable beating. [They] were very senior scientists, mostly scientists, [highly respected in their fields], who agreed to [serve. It] was somewhat difficult. [Ironically, later in life I served on PCAST, the successor to PSAC, for sixteen years under both Republican and Democratic presidents.]

The second tour I was in [government], it was less difficult. [. . .] I dealt a [lot with the Army Science Board and] I dealt with the Defense Science Board a lot throughout my career. [. . .] I think [it] made a major contribution. I have to disclose I [once served as] chairman of the Defense Science [Board, so now] I've confessed to that! But it was very effective. The PSAC less so; it became more a matter of critiquing what was done and not always in a very constructive manner. As you alluded to, Nixon finally got fed up and said I don't need that kind of advice. [. . .] I think one thing [that] bothered Nixon—and I don't know this firsthand—[was that members of the PSAC would publicly criticize his ballistic missile defense program. They] certainly had a right to do that; but then the issue came up were they using information gathered by virtue of their serving on the PSAC to publicly criticize him. On that, I would say, no, they didn't [have that right]. I'm not a lawyer, but legally, they had a right to [publicly criticize]. It's awkward. It's kind of a conflict of interest, and I do think that if you take on a position that you're going to advise somebody—this is a personal view—and you don't agree with what that person is doing, you should argue like the dickens in favor of what you think is right. If you're overruled, then the other person is the boss, not you; you back them up; unless it's an ethical issue, in which case you resign. You've always got the option to resign. And so that's my personal view how you handle a situation like that. [There were two such cases in my career where I resigned from a position. Whatever the case], it got so bitter between the president and

the PSAC that the PSAC ceased to exist. I don't recall for how long, but it was a few years before it was restarted.

EVANS: Yeah, that's, that's correct. I'm wondering if you read . . . and there's, kind of, been . . . you had mentioned the Defense Science Board and I think I want to get back to that too because I was curious about your experience there. But also in terms of advisory committees, another board that comes up is JASON, were you . . . did you work with them as your time . . . your first tour in the Pentagon or second tour? Were . . . and what was your experience working with them as opposed to say PSAC where you had more trying times with . . . ?

AUGUSTINE: I worked with JASON a modest amount, and it was a very constructive relationship. They didn't always agree with us; often they were right and told us so. And once again, it was principally on highly technical matters, but of course that all spills over. **<T: 195 min>** It's hard to draw a line at some point, but [I] dealt with JASON, dealt a lot with the Defense Science Board. The Defense Science Board [. . .] was quite different from PSAC. The Defense Science Board had an office in the Pentagon, not far from the Secretary's office. The Secretary took a personal interest in the Defense Science Board, and what it did, and what it had to say. [The board members were] very available. The head of the Defense Science Board essentially reported to the Secretary of Defense. The chairman of the Defense Science Board, which as I say, I was for a period—this was after I left the Pentagon—has an office [. . .] in the Pentagon, so they spend Saturdays, Sundays, or evenings there. They have another job, so they don't show up during the day. You have your own staff. The Defense Science Board has members [. . .] similar to PSAC, I think, in terms of career accomplishments and scientific backgrounds and so on.

When I was chairman, [the "White House" once] proposed two or three people, who were obviously being proposed for membership in the Defense Science Board for political reasons. This was handled by the [White House] staff, not by the President or anybody like that. I remember going [to them] and saying, "If you want to see the whole Defense Science Board resign, push those three people." And so it ended. That was the only time I ever felt there was something that was inappropriate [and] that was put to bed overnight. The Defense Science Board worked on problems across the defense spectrum. We tried not to do things that were just Army or just Air Force or just Navy, but, kind of cut across. We often had [ongoing] maybe four or five, six projects at one time that people worked very hard on. We were able to gather a really talented group of people [for these studies—some not members of the Board]—committed people, independent—at no cost to the government other than the cost of the office and our travel expenses. I think the Defense Science Board made a significant contribution. I think the same about JASON. And PCAST [did as well]. PSAC certainly had the talent [but] somehow the [constructive] relationship never developed, from what I could see, but I was a couple levels down and probably didn't have the perspective that [. . .] many people would have had.

EVANS: That's really interesting and helpful, and I want to return, I guess later, back to your . . . I guess maybe in the next interview you talk a bit more about PCAST and your work on the Defense Science Board. But I also want to be conscious of time because we're about fifteen minutes out.

AUGUSTINE: [. . .] I think we're both near the end of it. I need a few minutes to get ready. Maybe if you want to wrap up in five minutes [. . .] that'd be good.

EVANS: Yeah, sure. I think, I think we're at a decent stopping place. I think if there's comments you want to add about your experience as Undersecretary of the Army and Acting Secretary, then we can end on that, if you'd like.

AUGUSTINE: [. . .] As Undersecretary, you basically have the same responsibilities as [the Secretary]. I've never been in favor of having deputies or "unders." It seems duplicative to me, and it confuses people who is the boss and who could say okay. But in this case with Bo Callaway, I had a [wonderful] relationship. Bo had been a congressman, he ran Callaway Gardens, came from a very admired family in Atlanta, [Georgia], and Bo knew how the system—the political system—worked, which I didn't. [(But I was learning fast!)] **<T: 200 min>** [I had a business], engineering background and parts of the Army were business and engineering, like the finance part and logistics and research and development. Then there was legislative affairs and public affairs and recruiting and some really major . . . and Bo basically said, "We'll have an arrangement that you do the business and engineering part; I'll do the [other]." Obviously, he's the boss and in the end he gets the say. He was such a person—such high integrity—there was never an issue [between] us. We didn't agree on everything, but he'd hear me out, no problem. If we didn't agree, I mean, these were difficult issues, and it wasn't [always] obvious what was right. It was fabulous working relationship. [As] I said, I've had great bosses in my life, and he was one of the best. As a pair, it worked pretty well, and the Army [. . .] knew that on certain areas if I said it's okay to do that, then it was okay. I kept Bo informed, obviously, what I was up to, but I had my own [work to do].

[. . .] I was only Acting Secretary for maybe three months or something like that. In that role I became much more involved in [things] like the volunteer force. [. . .] The Volunteer Army was basically created at that time. [I give Bo and General Abrams] an awful lot of credit for the volunteer force. [People ask why] the difference in the public's attitude toward the military today and [then. The other day I was looking, and] the military has just about the highest rating by the public in terms of confidence—public confidence. [. . .] You see that in airports, how [military] people are treated, where it was just the opposite in the sixties; yet the role of military has not changed; it's identical. So, what happened? Well, I think one thing that happened was the Volunteer Army. You had people in the Army that wanted to be in the Army; you didn't have people in the Army [who] didn't want to be in the Army. And the Army has done . . . the military has done a pretty good job of staying out of politics. So you have a totally

different environment today than was the case at that time. It was much harder then. [. . .] The Vietnam War basically ground down by the time I left my second tour.

It's a strange world [today]. I have a very dear friend who runs a major corporation in Hanoi, [Vietnam]. He's Vietnamese, was in North Vietnam during the war, finest person you'd ever hope to meet, and it's kind of true around the world. I've traveled to 129 countries from the North Pole to the South Pole, literally. And it's rare you meet somebody you don't like and can't get along with. Yet, as countries, we just can't seem to do it, and it's a mystery to me; it's a tragedy, and the amount of effort that goes into building military rockets [could have gone into building spaceships or doing other things]. [. . .] That I'd have a friend from Hanoi—a good friend—would have been unthinkable to me at that time. Individually, we [can] get along; collectively, we're [. . .] lost. That's probably the place to leave [this] discussion.

EVANS: No, I know it's really . . . it really is, yeah, like you said, a strange world that way it works. You know, yeah, we can talk offline, but it the same way that it's been really affecting me—so many of my friends through graduate school were Chinese. It's hard to see them villainized in some sense, and that is . . . so people we can be best friends.

AUGUSTINE: I think back—I don't want to run over our time here—on my mother's one hundredth birthday. One of my friends [from Saudi Arabia] sent her one hundred long-stemmed red roses—giant. You can't believe what one hundred long-stemmed red roses would cost. **<T: 205 min>** [. . .] Another dear friend of mine from Israel—[a retired Israeli general]—sent her a certificate [stating] that he had had one hundred trees planted in Israel in her name. My mom—a hundred years old—[asked], "Who are these [two] people?" I said, "Oh, they're friends of mine." She said, "Are they good friends of yours?" I said, "Very good friends." "Do they live near each other?" [. . .] "Well, actually, they sort of do." She said, "Oh, are they friends?" I said, "No, I don't think so." I [then] tried to explain to a one-hundred-year-old woman [something that is very] irrational and try to defend it. It's a hard task. [. . .] I guess, as you get older in life, you get wiser. Maybe . . . . I don't know. Good place to stop.

EVANS: Yeah, good place to stop. I'm . . . really it was very interesting to talk [to you]. That reminds that I need to go find my old box car, my Boy . . . my Cub Scout box car. I think I still have it somewhere and . . .

AUGUSTINE: Did you win?

EVANS: Excuse me.

AUGUSTINE: Did you win?

EVANS: I don't think I had any jet fuel lubricant. And it reminded me too my . . . there's a neighbor down the street, his dad was a NASA engineer and he always won. And so . . .

AUGUSTINE: That often happens.

EVANS: Well, it was really wonderful to talk to you, Norm, and I look forward to our next session. I think it's next week.

AUGUSTINE: Well, hey, it's good to talk to you. And I think our other project's coming together here now. [. . .]

EVANS: I think it is. I think we finally have a date, and the report will be published.

AUGUSTINE: That's great to hear. Well, you take care, be safe.

EVANS: You too, Norm. Thank you so much.

AUGUSTINE: Thank you.

EVANS: Take care.

[END OF AUDIO, FILE 1.1]

[END OF INTERVIEW]

INTERVIEWEE: **Norman R. Augustine**

INTERVIEWERS: **David J. Caruso**
Kenneth M. Evans

LOCATION: **via Zoom**

DATE: **15 October 2020**

EVANS: Okay, great. So last time, if I recall correctly, we were . . . we, kind of, came to a natural stopping point where you were transitioning out of your post in the Army. So I think during that time, I'm sure that you were getting lots of offers to go back into the private sector. But you wound up at Martin Marietta, and so I was wondering maybe you could walk us through what you were looking for in your next position, why Martin Marietta was so attractive to you, and, kind of, your experience transitioning out of the Pentagon back into the private sector.

AUGUSTINE: Okay, all good questions. [. . .] I mentioned the circumstances why I left the Pentagon. It was a transition to a new administration, [but] the election had not yet occurred [and] we didn't know what ["flavor"] the new administration would be. [. . .] I clearly viewed my career as being in industry, not in [government; the tours in] government were, kind of, a public service. So, I had told [the Secretary that win, lose, or draw on the election, I wanted to leave. I came] within one day of accepting a job with another firm [when Martin Marietta came on the scene]. I wound up going to work with [them] because of a phone call I got [. . .] one afternoon before I was going to take the other job! Interestingly, the other company was Fairchild Aircraft, which has [since] gone nowhere but straight down and Martin Marietta [went] straight up. Once again, I made a lucky decision. I [of course] had no way of knowing [. . .] that was what was going to happen.

[. . .] I left the government on one day and went to work the next day at Martin Marietta. We were out of money again. I'd spent so much of my career [until that time in the government that our] expenses were generally exceeding [my] income. [For] example, the government said they would pay my [expenses] to move the family [from Dallas] back to Washington, [but] when we got there they said they had made an administrative error: they couldn't do that. [It] cost me, I [think, seven or] eight months of pay just to move my family. [Anyway], I went right to work the next day at Martin Marietta. The reason I went there was [that] I wanted to work someplace [. . .] it had to be in aerospace [. . .] where I would not be placed in a position of conflict of interest with my prior government job. I knew the people at Martin Marietta quite well, and I considered them to be people of integrity. [I had told them that I] couldn't have any contact [on any project I'd been involved in with] the government, and that, personally, beyond what the government requires, for a couple of years, I didn't want to have any contact with the government on behalf of Martin Marietta [at all. If] they wanted to hire me under those

circumstances. They said, "We'll give you a job that's totally focused internally." [I replied], "That's great. What's the job?" The job was to be—I [forget] the title—but it was basically vice president of [technical] operations, which meant that I would oversee engineering [and manufacturing within the corporation and] oversee our capital facilities, our capital assets, [and so forth]. I would be dealing with the various divisions of the [company rather than with the government. This] suited me perfectly, and it worked out really well because I learned a lot about the company.

CARUSO: Yeah, and according to my records, the position was vice president of technical operations.

AUGUSTINE: That was it. **<T: 05 min>** Anyway, that's, kind of, the answer to that question, I think.

EVANS: Was there . . . so there was a . . . so it looks like . . . maybe first before we jump into your time in the . . . So this was 1977 that you joined with Martin Marietta. Could you maybe describe some of the projects you were working on and, kind of, the job as you remember it, and whether or not you kind of . . . it fit with what you're looking for moving back into the private sector?

AUGUSTINE: Yes, it fit very [well. The] company, of course, had a broad variety of projects and [initially] I tended to deal a lot with the Air Force and Navy projects as opposed to the Army projects because I'd come from the position with the Army. There were a number of classified space programs that I was involved in—[also] the Titan launch vehicle. We were just building the new Titan IV, which was a gargantuan launch vehicle [. . .] for its day. The Space Shuttle was just getting [going. We] were building the giant external tank for the [Space Shuttle at a plant] in Louisiana. We were building a bunch of fire control systems and electronics for the Air Force, building the launch system for the Navy's Aegis Surface-to-Air Missile, we were building parts for some [new commercial jet engines. We] were building a ramjet—actually called a scramjet—that at the time was quite unique, [but ramjets] sort of went out of favor for thirty years and now they're very much back in favor. [. . .] China and Russia are flying them and we're about to in this country [again]. So it was, kind of, a variety of things from systems at sea to systems in the air to space, but it was very technically oriented, [although it included] managing financial matters, schedules, and so on [for technical problems]. But it was [basically an engineering job and that pleased me].

CARUSO: So one thing that I'm curious to know a little bit more about. Were . . . was your company responsible for designing the parts or were you also building the parts yourself, that you had plants and you were operating the plants where the devices were physically made?

AUGUSTINE: The company was basically a systems company that built systems that you put in the hands of the user. [We built missiles], space launch vehicles, [electronics], spacecraft. [Just before I got there, they had designed and built the first two robotic] soft landers on Mars. [They were] very successful. They mostly built systems, but then there were [also some subsystems. For] example, the launch system for Aegis was a major component or subsystem of Aegis. The aerospace industry kind of breaks into two pieces—those who build major systems and [those who build parts of systems and] subcontract to the major system suppliers. But some of the major system suppliers, for historical reasons or competitive reasons or whatever, also built some subsystems too and sold them to other suppliers. One of the very interesting things about the aerospace industry that I have found to not be true of the other industries I've been associated with was that the [leaders of the aerospace industry tend to be] friends. We all knew each other well outside [the business world as well] as **<T: 10 min>** in the business world. One reason [. . .] was that we all had contracts with each other. At one point, Boeing was our biggest subcontractor, and we were Boeing's biggest subcontractor. That has a great policing effect, because when people are looking for other companies to team with, they know who was honorable when they were on your team—and who was not—and so your reputation counted for a lot because it followed you around. [Another thing is that] the companies were almost all run by engineers in those days and [. . .] were doing stuff that was exciting at the leading edge of engineering technology [and important to the nation. The] industry was extremely competitive in spite of what a lot of people might want to have one believe. [Also, of course, everyone had to qualify for a high-level security clearance.]

There are a couple reasons for the competitiveness. One is if you were, for example—as we were [when we became Lockheed] Martin—in the military fighter aircraft business, a new fighter [contract] only came out maybe every fifteen, twenty years or more. [The] contracts were huge, but there was only one winner. If you won [. . .], you were in great shape for twenty years; if you lost [. . . For example, when we competed with McDonnell Douglas for the [Navy/Air Force vertical takeoff combat aircraft we won and] McDonnell Douglas was out of business—[bought by Boeing]—a couple months later. [. . .] So the competition was [intense]. But somehow the people in the industry, and [. . .]—as I say—it wasn't true in most other industries I've run [across, we were friends, albeit] very competitive. [When we would compete against] McDonnell Douglas, the first person who called me to congratulate [me if we won] would be Sandy McDonnell. [. . .] Sandy and I had gone to the same [college, we both had been presidents of the Boy Scouts of America], and so on. It made it a very pleasant industry to work [in] in that regard. I remember visiting [the headquarters of one of the major] grocery and commercial products firms. When you went in the headquarters of most companies—we didn't do this, but a lot did—[. . .] have a picture of the CEO and the chairman on the wall. [But at the grocery firm] they had pictures of their competitor's CEO and chairman on the wall! [It led] to an interesting situation, but we were basically in the prime contract business and that had important consequences for us later on. We can come to it.

CARUSO: One of the things I was asking about manufacturing is thinking about the 1970s, developing high tech equipment, spaceflight, military weaponry, things like that. Obviously, specifications are very important, right? If something needs to be a certain number of

millimeters, if it's not that, something could blow off. You talked about your experience early on in your career where you had something blow off because of something that wasn't taken into account. I'm also thinking of the conversation that we had briefly about computers and your slide rule. I'm curious to know in the 1970s, or I was curious to know in the 1970s—late 1970s—before the advent of the personal computer, you know, what was it like manufacturing these devices that needed to be within very tight specifications or you'd run into some big problems, right? You don't want a plane falling out of the air because something was a centimeter too big. So that's where my question is. I . . . maybe you don't have much to say about that topic, specifically, but I just wanted to raise it.

AUGUSTINE: [Manufacturing came under my job at] **<T: 15 min>** Martin Marietta. In some ways, it was a lot different from today; in other ways, it was not. At that time, many of the materials we use today [we] were just pioneering; alloys of aluminum were just being introduced [into widespread use]. We'd used aluminum for a long time, but [not] the special alloys. There was, of course, no such thing as additive manufacturing. We couldn't even have imagined such a thing—["printing parts."] I've got some here on my desk; I've got [holds up laser printed paperweight of Lockheed Martin logo] . . . we never could have [built] . . . that would have cost us a zillion dollars. [. . .] Well, now it's printed, no big deal. The idea that [if you are] missing a wrench on the space station, you can transmit through [electro-magnetic waves to the Space Station instructions for] a machine that would build the wrench [right] on the space station. In other words, you could [. . .] transmit a wrench, in essence, through additive manufacturing. That was [. . .] revolutionary.

As you say, [. . .] we weren't equipped to deal with some of the tolerances, particularly [at] high temperatures. I remember [that on the ramjets] we were building, the inlet [would swell] from the heat—the pressures—[. . .] significantly, and its dimensions would change. [This] would change the aerodynamics. You were [. . .] flying something that moved depending on the temperature. The old [Lockheed] SR-71, Mach 3.2 [. . .]—the fastest manned aircraft. That was a long time ago, but it [swelled] up so much, expanded [and tightened some joints from heating] when it flew, that it was designed so that it would be at the [desired] configuration when it was really hot. When you landed it, brought it into a hangar where it was cooler, it would shrink and [would then leak fuel and oil]. When you put these huge airplanes in a hangar, you had to put a giant [tray] under them because they dripped the whole time. When you walk in the hangar and see these airplanes dripping fuel [. . .] I mean, once again, you couldn't imagine that today. That was done back in slide rule days to get those tolerances, those calculations, I marvel at what they did.

Manufacturing, of course, is much more automated today. Printed circuits by then were in existence, but [with] orders of magnitude larger line widths that we deal with today. [I think that today you can] put about a million times more circuit elements on a chip than we could back in those days. The first item like a chip that I worked on [for a space program had twenty-four elements]; today it would have millions. [We] still had analog computers in those days—believe it or not—where you ran wires and used plugs and stuff. The early digital computers were available at that time but [still] fairly primitive. [The] first digital computer was in the

[1940s. As I recall, the Electronic Numerical Integrator and Computer (ENIAC)] had eighteen thousand vacuum tubes, which today would be a minor [part of a] chip the size of your fingernail. [. . .] Just before the period we're talking [about, when you put circuit elements on a circuit board that vibrated. After] <**T: 20 min**> they were assembled, [you put them in a tray] and then poured [plastic around them] so that they couldn't flop around and bang into each other. [. . .] The only problem was is if one of the [elements failed, somebody would have to take dental instruments] and dig the plastic out to replace the [failed component. Maintenance] was a true nightmare. Today, you [can] throw the chip out and put a new one in, because [cost] dropped by six orders of magnitude [in the last fifty years].

CARUSO: When you started that position, it was right at the beginning of the Carter administration, right? 1977?

AUGUSTINE: That would be right, I guess. [. . .]

CARUSO: Okay. And it was just, I think it was 1979 when we had the oil crisis. I'm curious to know if anything about working where you were during the Carter administration or during the oil crisis had an impact on what it was that you were meant to be doing at the company, right? Having a democratic president, you know, obviously if you're dealing with military materials, while there is the stockpile of oil meant to make sure that our military and other things keep running, when there's a crisis and you're working in an industry that relies heavily on fossil fuels, I'm wondering if there was any impact on the company that you needed to address or that you needed to think through.

AUGUSTINE: Well, to our company—Martin Marietta—it was a very big deal because we were in five different businesses, several of which were enormous energy consumers. [We] were in the cement business, which is notorious for the amount of energy that it requires; we were the rock crushing business—aggregates, [as] it was called. We were in the chemicals business. We were in the aluminum business, which requires [a lot] of energy, and we were in the aerospace business. [In aerospace] we were the least dependent [in] the company on energy. But from a military standpoint, it [. . .] drove home just how dependent we were on the Middle East. And also [. . .] how important fracking has been [subsequently]. It's changed the whole geopolitical equation that we now can do fracking, but we didn't know how to do that in those days so we were very dependent upon foreign oil. I think [. . .]—I've forgotten how much—I think it was a billion dollars a week [. . .] we were exporting for fuel in this country. [. . .] In terms of the [military aerospace industry itself], I wouldn't say the impact was overwhelming. It was a huge inconvenience to our employees trying to get to work—couldn't get gas. If you did, you had to stand in line forever—a lot of wasted time. We were [. . .] of course trying to help the military train with less fuel.

There are some classic stories about that. Between World War I and World War II, there was a ration put on oil for the Navy for financial reasons. [There were six destroyers that] were to sail from San Francisco, [California], to San Pedro, [California], I think it was. It was on the West Coast. They were given an extra ration of oil so they could sail at flank speed, which destroyers hadn't done in several years because of the fuel consumption [limits]. Anyway, it was a foggy day [and] they were going down the West Coast. There's a point that sticks out from the [coast] near Vandenberg Air Force Base called Honda [Point. The destroyer in] front was navigating and the other five [were] following closely behind watching [the running lights on the preceding destroyer]. The first ship went <**T: 25 min**> aground, [and five followed it. The lack of training caused by the lack of fuel [was determined to be the cause. It] changed the way the military operated during that period. [. . .]

In terms of the change of [administrations]—I'm having to think who came when. [I've met every president, I think, since [Harry S.] Truman except for President Trump]. I've worked for every one in one capacity or another [. . .] since [Jimmy] Carter. No, who was before Carter? [. . .] I guess I worked for everybody since [Lyndon B.] Johnson in one capacity or another. I just missed Kennedy. For sixteen years, I was on the president's science advisory board [President's Council of Advisors on Science and Technology] in chunks of four years for presidents of both parties. And the surprising thing is the best of times and the worst of times [for the defense industry] were under President [Ronald] Reagan. It was the best of times because [. . .] defense spending was rising significantly. The defense industry was the leading edge of technology; that was a place you wanted to be if you're an engineer. And the reason it was the worst of times is that [. . .] Cap [Caspar W.] Weinberger felt that if he was going to get all this money for defense, he had to make clear he was a very good steward of that money. And so under Cap, who's a friend, the Defense Department started all these attacks on industry [. . .]: Lockheed for charging too much for a toilet seat—you may remember that—[whenever the cartoonist showed a picture of Weinberger, he had toilet seat around his neck]. They got after General Dynamics for charging too much for a screwdriver. They got after us for charging too much for a roll of tape—six rolls of tape—and we became the villains of the world. And if you looked into each of these things—I could walk you through the six rolls of tape because I know it by heart—the industry was doing [precisely] what the rules required. But we [. . .] became the villains. Even though times were good financially, they were terrible in terms of our image. Trying to encourage people that they'd like to work in our industry, other than engineers [because of the technical challenge, it was difficult]. Is this where you want to be?

CARUSO: Now I know that . . . . So there are two things: I know that you were elected CEO in '87. You also mentioned that when you when you took up your position, you wanted to stay away from military things for ethical reasons—right?—you'd just come out of the military. You felt it would not be good for you to be managing things happened to do with military contracts. I'm just curious to know if sometime between when you came on as vice president of technical operations and when you were elected CEO in 1987 and chairman in '88 did you start working with military contracts again and if so, in what capacity?

AUGUSTINE: [My only issue with working with military projects at Martin Marietta was my concern over potential conflicts of interest associated with my earlier service as a government employee working for the Army.] In 1982—five years after I left the government, [I was largely clear of the government restrictions]. I was still at Martin Marietta, and I was asked to run our astronautics [group], which was located in Denver, Colorado, which of course is where I had grown up and where my parents were living, and I love the mountains. So, for me, that was like being thrown into the briar patch as Br'er Bear would say. So I went to Denver. [The business there] was all with Air Force and NASA, which I had no conflicts with. [. . .] There was an interesting story there. <**T: 30 min**> By now [. . .] my son was off in college at Texas A&M [University]. My daughter was starting her senior year in high school, and they asked me to go run the [astronautics] plants around the country. The group—the astronautics group—was headquartered in Denver. It was a tough decision [to move] because my daughter was "settled" in school [in her senior year. There were several choices]: several of her friends' parents [offered] for her to live with them for her senior year, so she didn't have to move. [One] option was for my wife to stay [. . .] in Washington and for me to go to Denver for a year and commute on weekends. Or we would all pack up and go. We left the choice up to our daughter. She chose to pack up and go—all of us—and it worked out great. In fact, she said later it was a plus because the following year, when she went off to college, she was used to moving and making new friends as well as leaving your family [and moving—all at one time—as was the case beginning college. Two] steps rather than the one step. She was probably being a good sport, but anyway, she felt it was a good thing. So we did that.

Anyway, moving . . . fast forward I commuted during the logistics of [. . .] buying a house and so on. I came back to Washington on weekends to close down the place [there. When we all] get to Denver, my wife and daughter [and I arrive, a] moving van pulls up in front of our house in Denver, and I get a call from the CEO who [my predecessor as] CEO—Tom [Thomas G.] Pownall is his name. Tom called and said that our company was the victim—intended victim, important distinction—the intended victim of a hostile takeover attempt by the Bendix Corporation. [. . .] I always describe it as the [business world's] equivalent of nuclear war, but without the dignity. Bendix, that morning—I don't think I told this story, did I?—a lawyer for Bendix shows up [at our headquarters in] Bethesda, [Maryland], with a letter to our board from the chairman of Bendix—CEO of Bendix—saying that they had just bought 5 percent of our stock—at which point they have to confess publicly that they bought 5 percent of somebody's stock. [They intended to take over Martin Marietta]—buy all of our shares, take it over. Tom told me that was situation. And the next few days, Bendix managed to acquire 72 percent of our [. . .] stock. So they owned us; the Bendix Corporation owned Martin Marietta. And so, my wife says, "Do we tell the moving van to keep [unpacking], or what do we do?" [. . .] I said, "Let's keep moving." So we put my daughter in school and moved. [The] battle went on for—I don't really remember—three or four months.

The [ringing noise] . . . that's my fax. The story was a grand story that I'll condense here, but Bendix literally owned us. And [none of us, the management of Martin Marietta], wanted to work for Bendix. First of all, we didn't admire companies that did hostile takeovers. Secondly, we [wanted] to work for a systems company, [and] Bendix was a subcontractor, by and large. So we were either going to get fired or resign, one way or the other. It was clear our

time [at Martin Marietta was likely] over. Our board gets together with Tom, our CEO, and says, "What's our strategy? What are we going to do?" And somebody, [. . .] a brilliant guy on Wall Street, who was representing us, came up with a strategy that before Bendix could stop us, we would buy Bendix stock! [. . .] I guess you haven't heard this story. So, we started buying Bendix stock as fast as we could. [We bought] a majority of Bendix's stock, and it turned out that a huge chunk of their stock was held by the Bendix **<T: 35 min>** employees' pension fund. We had made such a good offer that the [Bendix] pension fund [wanted to sell their shares to Martin Marietta! We took it to court]. Anyway, we finally got the majority of Bendix shares and [. . .] we literally owned each other. We wanted to use their boardroom and they wanted to use our boardroom. We were competing with each other on some [new contracts], and it was a strange form of competition because we wanted to lose. [If we lost and since we owned them we] got the money. If they won . . . David, you just disappeared. I don't know if you're still with us.

CARUSO: I am. I'm just shifting.

AUGUSTINE: But the problem was that Bendix wanted us to win and for them to lose, because they would get the money if we won. And so we're <u>both</u> trying to lose, and that's hard to do. [. . .] Anyway, it was on the evening news every night. It was called the Pac-Man Defense after . . . in those days, [that was the second] video game where these little fish-like creatures swam around and ate each other up. And so we were eating each other up. We finally settled it [when] we got the Allied Signal Corporation to join with us and buy up the rest of Bendix's shares. So, we owned Bendix [. . .]—almost entirely. The Bendix Corporation ceased to exist, and Bill [William M.] Agee, [the Bendix CEO], got fired. We got our independence and life went on. This is [how I first arrived at Denver]. At that time the [group I was running was] the biggest profit maker for Martin Marietta, and [the corporation] took on an 82 percent debt to capital—debt to equity, excuse me—debt to equity ratio. I'm pretty conservative, when it [gets up] into the thirties, I got worried, but this was [the] eighties. This is the kind of stuff that [the guys in Silicon Valley] do; it's not Warren Buffett kind of stuff.

Anyway, we managed to survive. We got very lucky [and] our stock did really well. The stock market as a whole went up, [so] we bought ourselves back. [. . .] I was in Denver for three years. We had a little barber shop in the plant there so that our employees [could] get their haircuts and not have to spend their weekends [. . .] waiting in barbershops. So I'm in the [plant] barbershop, which we referred to as "rumor central" because that's where if you wanted to know what was going on, [. . .] that's where you went! So I always looked forward to getting my hair cut—as much as there was! I'm in the barbershop one day, visiting with the barber. I said, "So what's new around here?" I always liked to get the news. He said, "Well, we understand you're going back to Washington." I said, "Oh [no. The deal was I'd stay here] at least five years, and [. . .] we've only been here three years. That's not part of the deal, so your rumor is wrong for once." About a week later, I get a call from the headquarters—the CEO said the board has met and would like [me] to come back and become corporate vice president [and run] the information systems group, which I knew a little about but not a lot. You know, when

you take a paycheck from somebody, you sort of try to do what [they need. So] we packed up and [moved again. By now, my daughter is] off in college at Duke [University]. So that my wife and I packed up and flew back to Washington and I did that job for about six months. [It] was really interesting. It was very different; of course, information systems [were] just skyrocketing in the world, and we were writing more code at that time [at Martin Marietta than Microsoft].

Anyway, I was in [that] job for about six months. Let's see if I get my sequence right here. <**T: 40 min**> One day my secretary said that they want [me] to come in the boardroom; the board is meeting. So, okay, that happens occasionally. Not a lot. So I go in the boardroom, and everybody in the room stands up and applauds. I look behind me to see who came in the door behind me, and [the Chairman] said, "Congratulations! You've just been elected CEO." I frankly had no idea that [was the plan] since my boss was a level above me [and I assumed he would have the job]. I had two bosses actually, [both guys I really admired and we remained friends until they both passed away. My immediate boss said he would] stay and work for me for a while. [The CEO was] going to retire [and] did. Totally out of the blue, I go home to my wife and say, "Guess who's the new CEO of Lockheed Martin." She says, "Who? 'K'?" I said, "[Me. Thanks] for the vote of confidence." [laughter] Anyway, that's the way I got the job, I believe that was '87, '86—December of '86. And then in early '87—I think it was June [. . .] or something like that—I became chairman as well as CEO. Then—let's see that would be '87—then it was in '89 [. . .] that the Berlin Wall fell, the Soviet Union ceased to exist, [and] the defense industry collapsed. I'm kind of rambling. [Do you] want me to continue in this vein, or is it . . . ?

CARUSO: Well, yeah, I'd love to hear more. I think the only other question I have, and we can return to it later was when you originally went into government, I think you had mentioned that part of the reason you wanted to do so was to get a better understanding of, for example, you know, how is it that you . . . like navigating contracts and putting in bids and understanding that process. So it's not something that we need to discuss now, but I am curious how your time in the military maybe played a role in how you were envisioning things once you became CEO and stuff like that. So please continue with the story, and if that comes up, just talk about it.

AUGUSTINE: Well, I'll pick that up. When I had become Undersecretary [years before], I assigned myself the task, I made it my mission the first hundred days [on the job, to visit every division . . . active-duty division . . . in the Army. This] meant traveling from Panama to Alaska [and Hawaii to Germany to try and] get a feeling for what life is like out there. What are the problems they run into? Wherever I went, I always tried to find an occasion to sit on a log somewhere with a bunch of soldiers or climb in a tank with some soldiers and talk [with] them about what life was like, what their equipment was like, and what kind of problems they had. Very often, there were things that could have easily been solved in industry, [but because of bureaucratic requirements, industry] wasn't aware of the problem—they had no way of knowing. I'll give an example; it goes way back before Martin Marietta and Lockheed Martin. One of the companies I was working for was building a fighter airplane used [in] Vietnam—an attack airplane. [If] the airplane was hit by anti-aircraft fire, all the control cables and electronics

ran down tubes on one side of the airplane, and if it got hit on that side, it knocked everything out. Well, if you go back to the drawings, the drawings showed half the cables going down one side and a redundant pair going down the other side. So if one side of the airplane took a hit from anti-aircraft fire that didn't damage the other side. You could still control the airplane. Well, when they were [manufacturing the airplane] they say, ["Those dumb engineers."] "It's a lot easier [and cheaper] to just put all the wires down this [one] tube and not have to install another tube." There are a bunch of stories like that. [The problem was that it was months before the company even became aware of the problem and could fix it.]

Almost an identical circumstance had caused <**T: 45 min**> the walkways at the Kansas City Hyatt Hotel to collapse during an afternoon tea dance [where many people died]. It was a decision just like that. Well, the people [. . .] in the factory weren't thinking of what happens if you get hit on one side of the airplane and all of the wires are on that side [. . .] matter. But it was just little things like that that I learned as I walked around and talked to people and thought we [need] to find a way to get those messages back to people in industry because they could do a lot better job if they just knew. Particularly during the Weinberger administration [. . .], this "wall" [had been built where industry was the bad guy] and the government guys were dumb guys, or what have you. I discovered that neither was true—that the people in the government were some of the smartest, most dedicated people I've ever worked [with. Similarly, some] of the finest people [are in industry and care deeply] about our country. [. . .] I just developed an understanding for each other's problems [and limitations]. I also understood that in industry, if you're in the aerospace industry, there's no asterisk [on] your listing on the stock market [report] that says, "This is a defense company and [does not need to make a profit]." We had to get our employees from the same [places] as Intel, Google, Amazon, you go down the list. We had to compete for the same talent. When we went to the banks [for loans] or the stock market for equity, we had to sell our story just like any other company or any other business. We had to make a [competitive] profit. There was no question about it. And a lot of people in the government, at that time at least, didn't understand that. It was a valuable experience for me in that regard. Just [like] the old saying: walk a mile in the other guy's moccasins. There's a lot of truth to it.

CARUSO: One thing. So you'd mentioned the fall of the Berlin Wall and the impact that it had on the defense industry. I also know that you had done some work for NASA—right?—at Martin Marietta. Did the 1986 Challenger disaster have any impact on Martin Marietta? Were any of your parts or designs part of those systems?

AUGUSTINE: Another great question. It had a huge impact. Losing [the Challenger] crew and embarrassing the nation and knowing some of the crew personally, you can imagine the impact it would have on you. One of the things that [we used to do was] have astronauts walk through our factories and engineering areas and talk to our employees, not in [large] groups, [. . .] they walk up to you and talk to you about their family and [your job] and so on. I'll tell you, [it] brought home to you that we're not making peanut butter in this plant. When the Challenger—I remember exactly what happened [and where I was when it happened. The] initial [videos], if

you may recall, showed the side of the external fuel tank—this giant fuel tank that I've described, which we built at our plant [. . .] outside of New Orleans in Michoud, [Louisiana]. We built it for NASA, and I think I mentioned, it was so large if you put it on its side, you could [fit the Wright brothers actual] flight inside of it—the whole flight—[airplane and all]. Those early flights—what number was it? Is it twenty-seven?—[anyway, the solid rocket motor]—that we did not build—was attached to our fuel tank. The fuel tank was the structural backbone of the Space Shuttle stack, and the solid rocket motors were fastened on either side of it. When you look at the video, you can see this flame coming out of the fuel tank—liquid **<T: 50 min>** hydrogen, liquid oxygen—not good stuff to mix. You can see the flame flying out of our fuel tank—the hole in our fuel tank— hitting the solid rocket motors and then the whole thing [blowing] up. Initially, it looked like there was a failure in our fuel tank [. . .]; somehow it had developed a hole. Well, when we got more data, it turned out the problem was, as you know, [. . .] was an O-ring on the solid rocket motor, not on our fuel tank. Actually, the flames had gone from the solid rocket motor [through the seals between two] elements of the stack and burned a hole through the lithium [aluminum]—at that time [I guess it] was just aluminum—through the aluminum [. . .] of our fuel tank. It got to the oxygen and hydrogen and set off the explosion or added to the explosion. There was that initial period where we thought we caused [the failure] and there was some relief when we knew we didn't cause it. On the other hand, the loss was immense.

The company, and particularly in our space work, [tried to permeate such lessons throughout] the company. We have what we call "mission success," and honest to goodness mission success was more important to us than profits, jobs, you name it. We were [so committed. If you get the chance] to put two spacecraft on Mars twenty-one days apart, launch from the same [. . .] pad, and you won't get another chance for a couple of years because [of the positions of Mars and] the earth, you want it right. Everybody was so committed to get it right. And when you get it right, you usually make a profit too [. . .] because you don't have to fix things. [. . .] Everybody was checking and double checking. Nobody wanted to be the one who made the [fatal] mistake, and it was a very sobering experience.

CARUSO: Part of the reason I asked was again, I think you mentioned the fall of the Berlin Wall and the impact that had on the defense industry. I was wondering if you or other companies . . . . I mean, you mentioned [the] fact that the aerospace companies were kind of friendly with each other—right?—if that had an impact on the aerospace industry similar to what you then experienced later with the fall of the Berlin Wall?

AUGUSTINE: It did, because you [knew] who you could trust and who you couldn't. [. . .] If you and I sit down representing two different companies and start talking about selling our [companies, if that word leaks] out, then all the hostile takeover artists from the financial industry will start attacking your company and try to buy [it] out from under you. So, you had to have a lot of trust in anybody you talked [with about buying or selling a company. Just] like if you're buying or selling your house, you want to be sure that [whomever] you're dealing with is honorable. It was an interesting [time. Backing] up for about two years before the Berlin Wall

fell—and again, maybe it was my time in the government [when] I became more interested in the big picture [. . .]—I became convinced times were going to be tough for our industry. That was when the [Reagan/Weinberger defense build-up was underway. The] reason I became convinced it was going to be very tough was several-fold, multifold. One reason was that the defense budget had grown so large, and [. . .] defense needs were getting filled, that there [wasn't a reason to keep spending] like that—investing was going to have to turn [down]. Another was that it was clear Russia was getting in financial difficulty and wasn't going to be able to [devote as much to defense. The] idea of the Soviet Union ceasing to exist never [. . .] occurred to me. I mean, I would never have even thought of that. But there was enough evidence around that [. . .] things were going to be hard for our industry. [That wasn't unusual, we were always on kind of a fifteen-year up and down] cycle. And so there was reason to expect **<T: 55 min>** [what happened, but certainly not to the extent to which it happened].

Sometime during this period—I can't fix the [exact] time at this point—[. . .] I would gather maybe [. . .] five people in our company who were most involved in strategic issues, [such as] what becomes of our company. It would be the chief financial officer, the chief operating officer, myself, the person who ran our mergers and acquisitions business. [. . .] Anyway, there were five of us [. . .] and every Friday afternoon we'd go to my [house, go down in my basement and discuss the future of the industry and how we fit into this future. We decided it was time to build up cash reserves].

[Our] company had just been through, of course, the hostile takeover [episode]. To get out of debt, we had to sell [. . .] three of the five parts of our company to [. . .] raise cash to buy our shares back. [We still had the crushed rock company, which was a great business]. But we got rid of chemicals, cement, and [. . .] aluminum. So now there were just the two elements left. [We] would invite people from Wall Street and futurists and professors to come and sit with us one at a time on a Friday afternoon. You can't do that kind of thing at the office; there [are] too many disruptions, too many people hunting for you. [. . .] I gave a talk [during that period about how the industry was about to turn down]. I remember the audience was almost laughing. [Things] were so good at the time. Anyway, the bottom fell out overnight [with the collapse of the Soviet Union]. And as I mentioned, we lost 40 percent of the [industry's] employees—about seven hundred thousand [jobs were lost—along with three quarters of the companies, or aerospace parts of companies], in less than five years.

The question became what do we do now. Our strategy [had been that the price of companies would] probably drop severely, which they did. [The] day before the Berlin Wall [fell], if you wanted to buy a quality aerospace company, it cost—roughly speaking—[. . .] about a dollar to buy a dollar's worth of sales [of] a company; if it had a [billion] dollars of sales, it would cost you a [billion] dollars to buy [it], roughly. Not too long after the Berlin Wall, the price was twenty-five cents on the dollar. [This] is when you want to start buying companies. There was one huge assumption behind [all] this, that if it was wrong, [that] you'd [bet] on the wrong horse. [The critical] assumption was that defense would come back. [. . .] I've always been interested in history. I read a lot of history and biography, and this is kind of sad, but it [had become] fairly clear that as far back as humans trod the earth, [groups of] people didn't get along with each other. It's sad to [say—groups of people—individuals] do pretty

well—but groups, particularly nations, [often don't get along]. And if you look at [history], there aren't a lot of times where there aren't [several] wars going on. [. . .] It was our thought—my conviction, anyway—that the defense industry [would] come back. [. . .]

Did I talk about the [Secretary of Defense] Bill [William James] Perry meeting in the Pentagon with the leaders of industry that became known as the Last Supper? This is an interesting story. So it's right about this time when everything has collapsed and the industry's strategy, the [initial] strategy, was [that when] there was a new airplane [to be built everybody] in the industry [would climb on that program] and one company [would] build the right wing, somebody else the left wing, [somebody else] the vertical tail, the horizontal tail—every company had a piece of that airplane—and they're all stacking [. . .] overhead on it. They've all got a CEO, a chief financial officer, a half-full factory, and [. . .] overhead is going out of sight. **<T: 60 min>** [The] cost of the airplane was a nightmare. We weren't in it—thank goodness. The Defense Department [and Congress were] getting fed up because the cost kept going up—all the coordination and half-full plants had to be paid for. [Industry, too, was getting fed up because under the contracts it had to bear a share of the cost increase. The program was cancelled, to everyone's relief.] Anyway, Bill Perry is Secretary of Defense, extremely talented, honorable man—[no, he wasn't Secretary yet] . . . Les Aspin was secretary. He had [been] head of the Armed Services Committee for many years [. . .]. So Les is secretary, Bill Perry is deputy secretary, John [M.] Deutch is head of research and engineering—whatever it was called then.

So Les [Aspin] calls a meeting of the leaders of the top fifteen [or so] aerospace companies—not aerospace—defense companies, because there were shipbuilders there too. [He] invites us to dinner at the Pentagon in his dining room—[no reason given. Anyway], when you get invited to dinner with the secretary of defense [and] you're in the defense business, you probably show up. We all showed up and all of us [were] wondering why are we here. We had dinner [and I happened] to be seated next to Les Aspin. I said, "Mr. Secretary, why are we here? What's the occasion we're celebrating?" He said, "You'll [see. We're] going to give you a briefing in the next room." [. . .] So we go to the next room after dinner—nice meal—and Bill Perry gave the briefing. [. . .] I have a copy of the main chart from that briefing. I made a point of getting it a few days later from the comptroller's office because I thought it was truly a historical document. [At the briefing Bill] put up various charts, but the main chart [. . .] listed various items of military equipment: submarines, destroyers, battleships, rifles, tanks, mess kits, [. . .], fighter planes, and so on. The [. . .] first column was how many companies are now suppliers to the Pentagon of this particular item of equipment. The column next to it [shows how many such companies the nation] could afford is the future. And you didn't have to look very long until you saw [that] there were fifteen aerospace companies [now], and they needed [only] two or three. I made a particular note that in several areas they only could afford one [supplier], which I think [is horrible, speaking as a citizen, because it implies no competition]. I think two or three is bad; fifteen strong companies are [. . .] better than two or three strong companies. But that wasn't the choice. The choice was [to have fifteen weak companies or have two] or three strong companies. They've made the decision what their choice is, and they're going with the two or three strong companies. **[**That, under the circumstances, made sense to me. But in a few categories the answer would have to be one company.]

[Les and Bill] said, “The reason we called all of you [here] is that you’re in charge of the industry. And [this is where we want to get: two or three—in submarines only one. There] are too many of you. We don’t need most of you. [We aren’t going to pay for multiple overheads and empty factories.] And it’s up to you to figure out who goes [. . .]; the free enterprise system will work.” I mean, this was very sobering. Most of us were engineers, and Bill is not a guy to joke; I mean, this was serious stuff. By chance, I was seated next to John McDonnell, who was a friend, who was at that time running McDonnell Douglas, and John and I had gone to college [together—we weren’t in the same class. The legend for engineering schools]—you probably know—[is that the dean comes] in the first day of freshman year and says, “Look to the person on your left and the person on your right. Take a good look, because [. . .] four years from now, one of you won’t be here.” I’m sure that was going through all of our minds, being engineers. [. . .] I looked to my left and I was seated on the aisle, so I [turned] to John McDonnell and [whispered], “Too bad for you.” [laughter] He smiled because he knew exactly what I was thinking [. . .]; he was too. Anyway, the next day—a piece of trivia—a reporter . . . of course, the reporters were all dying to find out [why we were at dinner together in] the Pentagon. **<T: 65 min>** A reporter asked me, “Why were you there?” On the spur of the moment, I said, “It was the Last Supper,” and that stuck. [To] this day they refer [to the Last Supper] being the turning point in the industry. The companies had to decide what to do.

By chance, [shortly after the Last Supper], Bill [William A.] Anders, who ran General Dynamics, and I [and our wives had scheduled a dinner together]. We had been friends [since] way back when. Our wives knew each other, and Bill, of course, was an astronaut. He was the first person—among the first three—to circumnavigate the moon, and [a] very talented guy. Anyway, Bill and I and our wives were having dinner [in] Potomac, [Maryland] [at] a little restaurant. [At one point] I said, “Well, [I guess] none of us are going to be in [the aerospace business in five years.” Bill responded that their strategy was to] break up the company and sell it. I said, “Our strategy is we’re going to try to buy companies, so I hope that there are a lot of people [who] have your point of view!” Fortunately, there were; there were a few buyers and a lot of sellers. So, we bought a lot of companies at twenty-five cents on the [dollar of sales]. Toward the end, the price went back up. We combined seventeen companies [. . .] or major pieces of companies to build Lockheed Martin, including [eventually] buying most of General Dynamics. [We] were able to build a company with a [great] capability and we reduced our costs to the government by billions and billions of dollars. I used to know the numbers; they were audited by the [GAO [Government Accountability Office]. We] would take two or three factories that were [one-third] full and combine [their work; shut one or two of the] factories and have one factory [left] that could operate with a critical mass so it was full and efficient. Saving money was easy; the painful part was [that] there were a lot of people we [wouldn’t] need; they paid the price. They were the ones that suffered. So that was my introduction to the CEOing world. [We] sold our aggregates business; we spun it off as a private company because it’s a fabulous business—much better than aerospace—you didn’t have government procurement [rules, we] never had a rock blow up that we didn’t mean to blow up! [Crushed rock] is just a good business. But [. . .] it had nothing to do with anything else we did—[we provided] no value added, so we sold it. With the money we got, we could [help] pay for some of the [firms] we were buying.

All during [the] period from the meetings in our basement [until] the Berlin Wall fell we were saving money and building up cash. We referred to it as our powder magazine. [When] things did go down—way more than we ever anticipated—[. . .] we weren't as smart as we looked . . . we had a big pile of cash so we could buy [good companies at bargain prices]. Anyway, the [resulting industry] was Lockheed Martin and two or three other [major] companies. Most everybody else went out of business or became part of Lockheed Martin or Boeing. [. . .] We had [sought to buy] Northrop Grumman as the eighteenth company. The deal was [agreed upon by the boards and the shareholders approved] it. [. . .] I had already planned to retire. [So we] announced that the deal had been put together for us to purchase Northrop Grumman—the Defense Department had encouraged us to do this kind of thing. Then I retired. [. . .] Am I getting into areas that are too business-like or . . . ?

CARUSO: No, no. I was going to just . . . one point for clarification. When did the Last Supper meeting take place—what year? Is this late eighties, or is this into the nineties?

AUGUSTINE: Let's see. I became . . . let's see the collapse [of the Soviet Union was '91], if I remember. The Berlin Wall was '89; then the Soviet Union ceased in '91, I think. So, this probably would have been [about] '93.

CARUSO: Because . . . So one thing that I do want to ask about and we can talk about it later since it did happen a little bit earlier. I know that, you know, there was the Advisory Committee on the Future of the US Space Program, and that was in 1990. And so I'm wondering if . . . . I want to hear more about that, how that came about, **<T: 70 min>** your time, you know, as you know, part of this project is focused on your time as a member of PCAST, so I want to spend more time talking about that. But I wanted to know if any of that stuff that had happened serving on these . . . on PCAST or on this committee if that played any role in what you're describing now or is happening in the 1990s, and if so, what role was it playing?

AUGUSTINE: I would say [it did not have an effect]. Most everything PCAST dealt with was [science]. I'm thinking back to things that I worked on—high energy lasers, microcircuits, K-12 education, employment policy of the Defense Department, [nanotechnology]. Nothing that . . .

CARUSO: Okay. Well then, I'm happy to hear more about you know what . . . the years you're describing now. Maybe once we wrap up that section, we can move back and talk a little bit about PCAST and your involvement there.

AUGUSTINE: Well, I'll just finish the last piece of this because it . . . to me, it was the second most disappointing piece of my professional career. [. . .] The first piece was having to lay off so many people who were talented, dedicated people who [helped] bring about the end of the

Cold War and then got laid off when it ended. That was the worst part of my career; we lost a lot of employees. The second worst . . . while we were still buying companies and being encouraged to do so by the Secretary of Defense, we had [the] agreement to buy Northrop Grumman. [. . .] I took retirement right after we announced it. The negotiations went on for about a year with the antitrust people. They were nitpicking pieces of the deal that they thought might be [an antitrust] conflict of interest. We said we would sell those pieces to solve the problem. [. . .] The antitrust issues [were] what they were worried about. Anyway, about a year later [. . .], I guess, one evening, one Friday, the antitrust folks called and told—couldn't have been a Friday, must have been a Thursday—told the Northrop Grumman management and the Lockheed Martin management that they wanted [both teams] in the Pentagon for a meeting with the Justice Department antitrust people Friday afternoon at five. The Lockheed Martin people asked me to come along, I think as a courtesy, because I actually [arranged the deal] along with the head of Northrop Grumman, [. . .] Kent Kresa.

During the year, [I had been kept posted since I was still on the Lockheed Martin board. There] didn't seem to be any major problems. [Anyway], the night before the meeting the Lockheed Martin team gathered [. . .]—I don't think the Northrop Grumman people were there, [. . .] I might be wrong, [. . .] but there are all these lawyers. And the only question I asked was, "What's the worst thing that they could tell us tomorrow?" The lawyers—[. . .] between the two companies [we] had three hundred lawyers who worked on the deal—the lawyers kind of mumbled and said the worst thing that could happen is they're going to make you sell the infrared business of the company in New [Hampshire—which we already had said we would sell] if we had to. So we go wandering into the meeting the afternoon the next day to [finalize the deal]. Another thing that had happened [is that Bill Perry had] left the Pentagon, and there was a new Secretary of Defense [William S. Cohen]. There was also a new head of research and engineering who actually I had recommended for the job—[a] very capable guy—but the two of them came in and said that we've got to get the system's attention and things are going to be different [now that we're here]. We happened to be the first people to walk through the door; Boeing had [. . .] walked through the door a few weeks before and bought Rockwell and that went through no problem even though Boeing [plus] Rockwell was a lot bigger than Lockheed Martin. We thought there's no way we're going **<T: 75 min>** to have a problem. Well, we walk in, and the first thing the antitrust guy tells us from Justice is that not only is there not a problem of small [overlaps], but there's no solvable problem [at all] and they're stopping the deal. That's the end of the deal; there will be no acquisition.

[Stunned, the] CEO of Northrop Grumman [. . .] said, "Look, I'm not selling my company because I want to. [. . .] The reason I'm doing this is that there's only been one competition for [a] new aircraft in twenty years, and we lost it—it was called the F-22." He said, "[. . .] They weren't [even] bidding on the F-35. The next time we're going to have something to bid on is twenty years from now, and do you think we're going to spend money getting ready for something that's going to happen twenty years from now? [And] when that happens, we're going [. . .] to compete against Boeing and Lockheed Martin and people like that." And he said, "We need to sell our company." Well, anyway the antitrust people said, "No way."

Northrop Grumman sued the government; we did not. It took Northrop Grumman a few months to discover that it's not a good idea to sue your best customer. [Eventually they folded too. Just] to close it out, I was the angriest I've ever been in my life, by far, [and] I'm not one to get angry. So I didn't say anything because I knew if I said something I would regret it, and I knew the people in the room—the Secretary and everybody. [The] Deputy Secretary [John J. Hamre] is a much admired friend. He was actually the guy running the meeting. Still a much admired friend [today]. Anyway, they changed the rules without telling us. And so the deal was dead; that was the end of it. And I've learned a lesson and that is—from a number of things—that when you deal with our government, get it in [writing; in government], people come and go. What one person tells you, very honorably, the next person may, very honorably, reverse [. . .]. There's no carry-over, particularly if there's a change of [political] parties—then it's almost sure it will be reversed. [Get] it in writing. I learned that. [. . .] That's what I learned. And it's a sad thing to have to say, but I learned it the hard way—a couple [of] times. That was the worst.

Going back to the PCAST and the like—oh, you asked about the space study. That was the first [. . .] I chaired two space studies for our government. The first one was for President [George] Bush Senior, 41. [. . .] Is that the one you were . . . the first one . . . ?

CARUSO: Yeah, I know that it was under Bush in 1990 that the . . . . I mean, PCAST had a long history. It reported to different people at different times, but it was really under George Bush—H. W. Bush—that it was renamed PCAST, and it reported directly to the president and that was in 1990. And so you're involved immediately. I want to hear not only about what you worked on, but how are you asked to serve? What was it described like to you? Why did you want to serve? So like that beginning information that, you know, we'd like to hear as part of the record.

AUGUSTINE: Okay. [Let's] see—I was still at Martin Marietta, I guess, at that time. [. . .] Throughout my career, I've been asked—when I wasn't in government—I've been asked to take on tasks for [. . .] the government. I've always done it for no compensation, often paid [costs out of my pocket. It's cost me in time devoted, too]. But [later], I didn't want to have a problem [so I sold] all my Lockheed Martin stock except one share. And I think I told you about [that; that did cost me a fortune by my standards]! I sold it [. . .] just so I wouldn't have any issues. [Anyway], at this [earlier point, I'm working] for Martin Marietta and I get a call that . . . of course, the Challenger has [failed a little before that . . . they had] put together a commission to figure out why the Challenger failed, and the President wanted to put together another commission to figure out [. . .] where do we go from here. **<T: 80 min>** They asked if I [could chair the latter one]. I said, "You know, I think I've got conflicts of interest that I can't deal with here." Running Martin Marietta, we were building the fuel tank for the shuttle and [other stuff for NASA during that window of time. I] said, "I don't think I could do it. [They asked], "Will you talk to the President?" I said, of course. I've been asked [to do so on occasion] so this was not [entirely] unusual. Anyway, I go to see the President, and President Bush asked me if I would do this. Of course, normally, I would have said yes at the moment; [I believe such things are one's duty as a citizen]. But I said, "I am concerned that this could touch on some of the

issues I have [worked on]; I believe I can separate myself from them . . . [and I could recuse myself occasionally] . . . just not participate in those parts where I have a conflict like the external fuel tank, which is [only a piece] of the big picture. [But I'm concerned about being involved]."

[The President] said, "You know, Norm, you could really help me. I've got a bunch of problems with agriculture." He said, "They're serious [problems] for the nation. [. . .] You could help me a lot, [but] you don't know anything about agriculture." He said, "I've got farmers all over the country who could help me with the space program, but they don't know anything about space." He said, "I'm sure you can figure it out." So how do you say no to the president? I said, "I'll try to figure it out." [. . .] I went straight from there to the Office of Government Ethics, which is a part of the government that really works. And I said, "I've got this problem that I've agreed to do something that I would like to do and I feel I should do, but I've got to be awfully careful that this [is] handled properly." The Office of Government Ethics is not one of [those that just quotes section 1633 of law number 125]. They sat down and wrote a letter to me on [the] exact issues I was going to be dealing with and said, you can do this, you can't do that. [. . .] I had an exact list, put it back through the White House lawyers, they said okay. [. . .] I shared it with everybody I worked with and with the lawyers for the committee and then NASA. It was agreed that I would leave the room when these topics came up—they didn't come up very much—but when they did, I'd leave.

[. . .] I agreed to do the job, and we put together a committee of people, and we tried to have a committee that was very balanced, as I've always [tried to do] when I do these things. I've chaired [nearly] one hundred committees for the government in my life, and [I] try to get people who have been on all sides of the [issue. We] had people from academia, we had astronauts, [we had] people in industry. We [had] former NASA employees. You name it. A really good group that worked [. . .] hard and made a series of recommendations as to what the future of the US space program [might] look like. It's been so long ago I barely remember all the recommendations, but some were implemented, some were not, as is usually the case. [. . .]

When it was announced that I was going to do this, Al Gore was a senator at the time. And so, Al Gore starts giving speeches about this guy Augustine from Lockheed Martin who is going to design the future space program, and it's going to obviously all be done at Lockheed Martin! I went to see him, and [. . .] said, "I didn't ask for this job, and I'm going to do it as honorably as I possibly know how. I'll probably lean over too far the other way, and anytime you want to have one of your attorneys sit in any of our meetings or any other discussion I have with anybody on this subject, you're welcome to do it. From your committee or your own staff attorneys." [Anyway], <**T: 85 min**> I didn't hear much more from him. When we [. . .] did our final report, to his great credit, he came with me and introduced me to [the committee running the hearing] and said I was here to present the final report, and he just wanted to acknowledge that we had done a fine job. [. . .] I thought that was pretty special. And I've always admired him for that. [. . .]

CARUSO: Sorry. When you started talking about the committee, you were using first person plural: "we pulled this committee together." Who is the "we"?

AUGUSTINE: It was the administrator of NASA, the president's science advisor, myself, and the legal counsel from NASA. That's the best I remember. There may have been others. [. . .]

CARUSO: Yeah, I was just curious how broad or how big the "we" was.

AUGUSTINE: Yeah, four or five people.

CARUSO: And now so, I mean, you have President Bush asking you to serve on this committee, to lead this committee. Did you have a broader sense of what it is that he wanted to accomplish with bringing this group of individuals together? You know, he's the one that in 1990 said, "Okay, we're going to form PCAST, the [President's] Council of Advisors on Science and Technology." Do you know . . . did he mention to you why he wanted to go down this road, why he was pursuing things this way when, you know, I think it was Nixon eliminated the whole idea of science advisors in the White House? I know it made a comeback a little bit under Reagan. Did you know what he wanted to accomplish with doing this stuff? Why bring people from outside government, outside policy to talk about these issues?

AUGUSTINE: [. . .] Nixon did eliminate PCAST mainly, [as I understand it, I think it was] annoyance that the members—some of the members of the PCAST [. . .] had gone very public opposing the ballistic missile defense system at the time, [when it] was a major political controversy as well as the toughest technical issue I was ever involved in. Fast forwarding, President Bush 41 becomes president [and the] Challenger has failed; the space program had been a source of great pride during a very dark period for the nation, and I [of course] can't speak for the [President], but I think he felt it was important [. . .] to see a space program continued. But it was somewhat in [. . .] disarray, given the failure of the Challenger, which—and I don't point fingers here particularly—[. . .] in my view, was preventable. Anyway, I think he thought it was important [to have a study] done basically outside of government so it would be independent, but report to the White House and indirectly to NASA. And the fact he took a personal interest in it was a big help to us in recruiting members. [It] was something that the president cared about, more people were willing to devote their time to it. [It] was clear this was going to take an awful lot of time. A lot of my evenings and Saturdays and Sundays for a year or so were devoted to the project. It was a good group of people.

CARUSO: So, how often did individuals . . . . So you mentioned just now, how often you were working on it. I'm curious to know where there official meetings? How often did the official

meeting happen? Where did they happen? Just, sort of, the . . . . I guess the basic aspects of how all this was working

AUGUSTINE: Yeah, you're asking me to remember back twenty years here, and I don't even buy green bananas at my age! I would guess **<T: 90 min>** that we met once a month [often for a couple of days] for the better part of a year. And we [. . .] had telephone conference calls—you didn't have Zoom in those days—periodically. We had little subgroups that would go off and attack a particular area in more depth than the whole group could deal with. Then there [was a] semi-infinite number of telephone calls between subsets of the members: one on one or one on many or what have you. [As] with all groups, some of the people devoted a huge amount of time; some devoted less, but everybody contributed significantly. I would say that there were no laggards in the thing. Anyway, we looked at [what we could learn, where we were, what were options] for the future, and what [would] we recommend. We came up with unanimous recommendations that I think had meat on them and [we] offered them to the President. As I say, I hope we made a contribution.

CARUSO: Kenny, do you have any questions specifically?

EVANS: About the Augustine committee? No, I was . . . . I don't. I think . . . . I mean, it's a very interesting story about how that happened. My only, kind of, follow up is you had mentioned the president's science advisor who at that time was [D.] Allan Bromley in helping, kind of, shape this committee, and I was wondering about—just in general—your relationship with him and impression of him and working relationship during that time.

AUGUSTINE: I think I've known probably all the science advisors going back to the sixties. I knew Allan. I knew him less well than most of the others, but I knew him. He helped us put the committee together but was not deeply involved in it once we got started. I don't know whether that was because [. . .] the President wanted sort of an independent look or whether he had other things to worry about—probably the latter. I don't recall a lot of engagement with him as we went along. There was no secrecy to anything that we did; our meetings were in [public], and we had reporters at most of our meetings. So he certainly knew what was going on. I suppose—I don't remember—I undoubtedly briefed him occasionally; I certainly saw him from time to time for one reason or another.

I guess one question that never occurred to me, your question suggests, is why [they didn't ask PCAST to do the review]. I think probably two reasons. [. . .] One was that I think he really did want something that was [. . .] remote from the White House and government, and I think the other [. . .] was that a task of this immensity was way [broader] than most of the PCAST people [as a group. You] could have picked a member of the PCAST to chair it. I don't remember if I was a member then or not. I don't think I was. He could have picked a member and said, "Go chair it." I've seen that [done]. But for whatever reason he chose not to, and I

think it worked. But another reason, too: PCAST has varied from time to time, cycled between heavily science-oriented, like when I first was involved, and then during the Bush eras, it became not only science but there were a few people with [engineering and business backgrounds, put] it that way. I think PCAST changed its character with the tasks that it took on. [. . .]

CARUSO: So maybe, and Kenny, if you have things to say . . . maybe this is good time to start getting into your involvement—direct **<T: 95 min>** involvement—with PCAST and trying to understand what you were just talking about—how it changed over administrations and roles and things like that. Does that sound like a good plan, Kenny, or . . . yeah.

AUGUSTINE: If I can chime in here, one of the reasons I was [sometimes] hesitant [in speaking just now was that] there was a second so-called Augustine commission that I chaired on the future of the space program that was for President [Barack Obama] on the future of the human spaceflight program. [The] human spaceflight program was kind of lost and didn't seem to be going anywhere. That was the more recent one I chaired. That one . . . that was the one we recommended shutting down the [Space Shuttle and recommended] letting new firms compete for hauling stuff into space. That left the door open for the startups in Silicon Valley, [California], to enter the arena, which incidentally was very damaging to my personal interests, but was [clearly] the right thing to do. Anyway, there was a second commission [that devoted] the equivalent amount of effort and had [a] clear impact. I mean, shutting down the shuttle was not [welcomed in NASA, Congress], or a lot of other places. The traditional aerospace industry wasn't thrilled about having the "[bandit] from Silicon Valley" in their backyard, [and] there were other things like that. But if you want to switch [to PCAST], I think I had mentioned I served a total of sixteen years under several presidents—both parties—[and] took on various tasks.

One just popped into my mind. Was I on PCAST then? I think I was. [. . .] It would have been under George W. [Bush] when 9/11 occurred. Anyway, on 9/11—just as an aside—I was traveling on a train [. . .] on the border of Afghanistan, traveling alone as a tourist. Not a great place to be at that particular moment, and it's an interesting story but irrelevant. Anyway, I made it back to [the] United States a couple [of] weeks later and was asked, [as part of PCAST to] draw up a possible organization chart for the [R&D efforts of the newly established] Department of Homeland Security. [. . .] There was no Department of Homeland Security, of course, before 9/11. So, I drew up [a profile of its R&D component. Then I was appointed an] ad hoc member of the Secretary of Homeland Security's advisory board. I participated in all [the] meetings, but I was not a voting member. My role was how do you [structure] Homeland Security's R&D, which was going to be significant. And it's funny how these things cycle—if you let me back up. Just before 9/11 there had been a two- or three-year study requested by the Congress that was chaired by Gary Hart and Warren [B.] Rudman, the two senators, and the question was, "What should be the US [defense] policy in the half-century ahead or quarter-century or whatever?" [. . .] I had served on that. One of our recommendations was that [the nation] create a Department of Homeland Security. We didn't call it by that name, but that's

what it was—a new department. We said what should go into it. Anyway, at that time [. . .] just as we turned our report in [from] a couple years' work . . . [the election—Gore/Bush, I guess, 43]—was closely knotted [and] the whole attention of the government was focused on counting chads <**T: 100 min**> and butterflies on ballots. Our report just flopped. I mean, it got zero attention. It was [a] pretty esteemed group, aside from myself, but the report just died. It had been requested [in law] by the House and the Senate. [. . .] It had gone on for a couple [of] years.

Anyway, I'm now sitting in PCAST. [. . .] I'm now sitting at the Department of Homeland Security on their advisory board—nonvoting. Later, when I left [PCAST], I became a [full] member of their advisory board for a couple years . . . several . . . a number of years. So that was one of the things we did that I was involved in. There was another issue that came up during that period of time that [it had to do with some special funding for NIST]. Chuck [Charles M.] Vest and I worked together on [it]. Chuck was the president of MIT. We were asked to take on a two-man task that had to do with [the former] Bureau of Standards, and we had managed to get [the president to put fifty million dollars in the budget to pursue the project].

CARUSO: [. . .] NIST? National Institute of Standards?

AUGUSTINE: NIST—National Institute of Science and Technology. We managed to get [all the way through] the House and the Senate. It turned out that the people that NIST thought it was going to attract a lot of attention [from something they were already doing]. I'll never forget that, because Chuck and I went to a lot of work and some other people [did] too.

We worked some on ballistic missile defense in those years—the technical aspects. There was a group of us that were supposed to serve as, kind of, referees [between work of the US strategic offensive systems and strategic defense systems]. How would you do the attack, and how would you do the defense? Then there was a group that was supposed to sort of referee it—the red team—and point out what [were] the mistakes and what could have been done. During the latter eras, it was more systems questions that were at the forefront of national issues. [In] the earlier days, as I said, [PCAST questions] were more science-oriented. [One I worked on was on nanotechnology].

CARUSO: So, I know you've had a lot of experience with PCAST under different administrations. One thing that I'm curious to know more about it is so you mentioned when you're working on that first committee for Bush Senior, it was to provide information to him, but you were also interacting with members of Congress, right? Al Gore was calling you out. But, you know, it ended well, right? He introduced you when you were giving the committee report. Did you have a broader sense of what PCAST was meant to do? Was it simply an arm of the president to find out more information, or was it meant to be something bigger? Was it meant to be communicating ideas, more broadly, getting the American citizenry engaged in discussions about science and science policy and things along those lines? Like, what did you

see as PCAST's goal when you first joined, and did you see those goals or see those roles change broadly over time as you served on it?

AUGUSTINE: I'm glad you worded it the way you did because I don't remember anybody coming in ever—they probably should have—and said, "This is why we're here, these are our goals," which would have been a good question [. . .] if I thought of asking. [laughter] But **<T: 105 min>** [PCAST] was there. My answer is going to be [. . .] my perception, which may not have been the right perception. [. . .] It varied over time, and when I first became involved, I had previously chaired the Defense Science Board for a number of years. I thought [PCAST] was kind of a Defense Science Board for the President, just like the Defense Science Board served the Secretary of Defense. [At] that time, the Defense Science Board dealt not only highly technical issues—high-energy lasers—but it also dealt with [system] issues like how much logistics you need to provide water for an Army fighting on the desert. It dealt with a lot of issues that went way beyond science, so I assumed [that the president might like independent and scientific technical advice].

I think three times in history has [the president] been an engineer. I don't know that there's ever been a scientist. I may be wrong—probably am—you would know. The three engineers, many people would say, were not our greatest presidents—or [at least] some of them. But [. . .] you have a president . . . you have a Congress that today, I think, has nine people in it that are scientists or engineers out of 535. You don't have a [Department of Science and Engineering]; you have a Department of Health, you have a Department of Transportation, you have a Department of Labor. There is no Department of Science and Engineering. Yet, science and engineering [drive] the economy today; there are [studies that won their authors] Nobel prizes that have indicated that [to be the case. It] seemed to me that it just made sense that the President should have a scientific advisor who should have a lot more clout than [. . .] he or she normally has [had], and that they might want to have a group of outside advisors to give them independent opinions, advice, or [ask questions—especially ask the so-called dumb] questions—based on their own experience that may be different from your own experience. Where else is the president going to get advice about science and technology, because almost everybody around him is a lawyer or [. . .] a banker? And it just seemed like a very sensible thing to me. I assumed [that] as you moved up the ladder, so to speak, [. . .] the questions would be less deep science and would be more [issues of broad public concern]. I don't think I ever sensed in any of the sixteen years that one of our purposes was to try to get the public more aware of the sciences or scientific [issues. Rather, it] was to help fill a vacuum for independent information in the fields of science and engineering.

And [. . .] there weren't many other places for a president to turn to get that [advice]—certainly not formally; there were probably ad hoc ways. [The] president had known people he trusted in prior lives that were engineers [or scientists]—maybe—I don't know. But PCAST, to me, became basically the [. . .] independent source of experience in science and technology for the White House, [for] the President in particular, through the head of [PCAST; i.e., the science advisor. It's] probably worth mentioning that as changes went on—my recollection might be the problem here—but in the early days, I recall PCAST—PSAC—being chaired by the person that

was the de facto president's science advisor. Later on I recall [it] being co-chaired by a person who was president's science advisor and somebody from industry. You may want to check that, but I'm pretty sure that's right. When that happened, there was more of a shift to today's problems—everyday problems—why did the Space Shuttle fail, why [. . .]? **<T: 110 min>** Ballistic missile defense through those years was such a highly politicized issue that it permeated [. . .] the discussions. [Basic] research, going back to the beginning, basic research was always a topic of major interest, and I would guess that [between, say, half] and 80 or 90 percent of the members were academics. There was clearly a strong interest in research and education and the impact it was having.

CARUSO: So, and I do think Neal [F.] Lane when we were interviewing him talked . . . spoke out about a co-chair when he first started PCAST and the presidential science advisor was also the co-chair. When you were serving on PCAST, obviously there are a lot of other individuals serving at the same time that you did, did you . . . did PCAST or did you specifically have regular relationships with other scientific bodies in the United States or abroad? I mean, so Neal, I mean, he was at the NSF [National Science Foundation], right? Not that he was actively—I'm trying to remember the specifics of his interview—I don't think he was actively going over to the NSF to chat with people when he was on PCAST, but, you know, he had a familiarity with that organization. The National Academies, right? There's this general interaction among various groups to talk about science. I'm wondering if you had or other members of PCAST, or PCAST generally, had interactions with other scientific organizations in the US and internationally. And what . . . if there were, what were those interactions like and things along those lines?

AUGUSTINE: [. . .] I think I need to draw a distinction here. As I recall, there were subcommittees of PCAST that dealt with classified issues where there was no outside conversation. Most of the work was unclassified—very public—[the] public sat in most of our meetings. [Most of the members of PCAST] belonged to these other—let me say—at least some of the members of any given [PCAST] probably [belonged] to the [National] Academy of Sciences, Engineering, Medicine or were familiar with NIH and NSF, [. . .] American Academy of Arts and Sciences, American Philosophical Society, and so on. And so there were these networks that people knew each other. There was no formal use of those that I could recall; I don't remember saying, "Would you talk to the people at NSF?" or something like that. But in the tasks that we addressed, if there was something that obviously related to one of these other organizations, there was no inhibition on going and talking [with that organization] about what you were doing. [. . .] Certainly, people talked to each other, and [these other organizations] knew what we were doing and what we were studying. I think there was a certain benefit to that because [. . .] in science, and I [am sure to run into it, somebody] down the hall is working on the same problem as you are and you didn't know it. This network, kind of, helped solve that. And the other thing that helped a lot, and I've discovered this in other areas I've worked, [was] where there are two people that each have half the answer to a problem, [but] they don't know each other. Some third party may say, "[You've] got to go talk to so and so . . ." And eureka, as the saying goes, you get [the] answer. [There are] some great cases of that. I think the advisory

committees to the President serve [that function. Then there's the] fact that the President [. . .] has group of economic advisers, [national security advisors, etc. The economy] is obviously important; he has plenty of legal advice on his own staff; so it just seemed like a natural thing to [have science advisors], and I think that the breakup of [PSAC by President] Nixon was a sad day in the story of science.

CARUSO: When you were serving on PCAST, **<T: 115 min>** you'd mentioned when you met with George Bush, Sr. and he asked you to serve on a committee, that was a direct meeting with the President. When you were serving on PCAST in . . . over those sixteen years, were you ever meeting directly with the President, or were you just receiving information from the presidential advisor about what the president wanted the PCAST have to work on?

AUGUSTINE: I need to answer this very thoughtfully because I've worked on so [many committees that I have] to be sure I sort out which ones were PCAST, but as I recall, once again, the PCAST policy varied [a] lot with who was president, [and who was] the president's science advisor. There were some presidents that we met with periodically. By periodically, I don't mean every month for sure, but a few times. There were other presidents that I don't ever remember meeting with in the context of [PCAST]. That may be just my memory, but there clearly was a change in the ebb and flow of how much direct involvement there was. In [most] cases—95 percent at least—[. . .] the involvement was with the president's science advisor.

CARUSO: Okay, and can you tell me a little bit more about how . . . so when the presidential science advisor came to PCAST with "this is the question that the president had," how did PCAST itself determine who is going to be working on that specific question? How were people chosen to lead or, you know, who was put in charge of that? Like, how did that functioning actually happen?

AUGUSTINE: As I recall, [PCAST]—at least during my era—[had] only two officers, or maybe even one, but there was no substructure by topic of interest or something like that. It was a very flat organization. So when the word came down from above—and [. . .] didn't have to come from above—it could come from one of the members, saying, "Here's a topic that we ought to be looking into," it really fell on the chairman, [who] would be the president's science advisor, to decide whether we should do this or not—but obviously in discussion with the President. And it really fell on the president's science advisor and [the] co-chair—if there was one—to figure out how to organize a group of people from the council of advisors to attack that particular issue. Most of the people were known pretty well—their backgrounds—to the president's science advisor, or certainly to his colleagues. I think that it was [. . .]—Neal could, of course, answer this better—but my span over sixteen years was pretty much a [case of where] the science advisor would pick out a handful of people who had some background in the topic at hand and ask them if they would serve on [a panel on] this particular topic. [. . .] I never heard anybody say no. Anyway, I think it was a [highly] informal group—less [formal], for example,

than the Defense Science Board, where [. . .] the board itself had a full-time staff and we had an office in the Pentagon, and we met many times a year. We went off for two-week summer studies as a group, with other [non-members] invited. [PCAST] was not like that. It was just very informal; when the president's science advisor told us there was an issue that should be looked at, we would figure out a way to do it. Occasionally, you'd report back to the President in person, but usually not. We would [sometimes] prepare written reports, and I suppose pieces of [them] got to the president.

CARUSO: And <**T: 120 min**> during the time, did you have many interactions with members from Congress like what happened with Al Gore or even more minor things? You mentioned that these were usually pretty public meetings unless of course there was national security issues, reporters were there so clearly Congress knew—or assuming they were reading what the reporters were writing—Congress knew what the President was interested in pursuing. Did you ever have contact from members of Congress that wanted to meet with you specifically or meet with PCAST broadly to talk about what you were working on and or to provide perspectives or anything along those lines?

AUGUSTINE: I never did. In my role there, I don't think I ever had the occasion. I don't recall any time I dealt directly with the Congress on any issue [concerning PCAST]. I think I probably would have felt it was inappropriate unless the science advisor had said, "We'd like you to do this," [because] of the separation of government. There was no secret about anything, but it just probably wouldn't have been appropriate. [But] on other things I worked on, there were many, many [. . .] briefings to [members of] Congress or [committees] of Congress or dinners with members or what have you. [. . .] I guess I [hadn't] thought that much about it, but [PCAST] contacts on the Hill would have been through the chairman of the [. . .] committee.

CAURSO: During your time on PCAST, maybe, obviously, you know, a decade and a half is a long period of time, so there's probably a lot of stuff that you've worked on, but are there any topics that you were asked to investigate that you found more interesting than others or topics that the . . . whatever report you generated at the end you feel more proud of than others?

AUGUSTINE: Hi Kenny. He dressed up. Oh, he's not there. That's a fake picture. He fooled me.

EVANS: I'm still here. I'm just . . . . I'm rearranging. I'm just . . . . I didn't want to be distracting. Just completely like made over in that photo, so I did the opposite thing. I distracted [you]. Yeah, no, I think it's really . . . . I think it's a good question about which reports and which topics you found to be most engaging.

AUGUSTINE: There were so many it's hard to pick and choose. [I particularly enjoyed a project on nanotechnology.] My interests tend to be pretty broad, so I guess the ones I probably enjoyed the most, being an engineer as opposed to being a scientist, were ones that dealt with applications of technology. Also, I was interested in some of the ones that dealt with personnel policy, for example: why is it hard for the government to hire the scientists and engineers it needs? [. . .] We made some recommendations [on that] that I think might have been important, most of which—maybe all of which—were disregarded. I'm trying to think back. Let's see some of the things I got caught up in [were] of the funding of science [but] that was [. . .] on the periphery of PCAST; [. . .] it wasn't PCAST itself. I don't recall any discussions of relationships with industry. There are some [issues] on manufacturing capability that were important and I think [. . .] did have an impact. It was during this era that [we were] [still declining in] **<T: 125 min>** manufacturing capability in this country and the implications of that, particularly when you look back at World War II and the role [that manufacturing played. It] comes back to the question you asked earlier—it was not [. . .] just the amount of manufacturing that's being done in this country, which is declining significantly, but also the type of manufacturing. That, of course, has a [. . .] very important consequence: there [were] a lot of very good jobs in manufacturing that are no longer there, [. . .] putting a major load on our educational system to do things other than train people to go to college for four years or eight years or what have you, [but rather] to train people in [skills. It] was more of those general kinds of things [that they would tend to ask us to do]. I did get involved in some fairly technical [studies in] particle physics and things like that. But I was always there as a referee, not as anybody to add [scientific value on] those kinds of topics.

EVANS: I'm wondering, so at least in my own history with science policy and report writing, during the time you're on G. W. Bush's PCAST, the administration had the American Competitiveness Initiative, and I'm wondering, you know, both at least according to some records, PCAST had a number of reports that dealt specifically like you're saying with competitiveness issues and workforce and broader, you know, science and the economy issues. What the varying roles in your involvement with both the *Rising Above the Gathering Storm* report with the National Academies and also how that impacted the American [Competitiveness Initiative] . . . the G.W. Bush . . . which I think at one point was part of his State of the Union address as announcing this competitiveness initiative. So maybe you could walk us through your role there with *Rising Above the Gathering Storm* and then PCAST and how the birth of this competitiveness initiative happened in that administration.

AUGUSTINE: Well, under both [Presidents Bush], competitiveness was a topic of [. . .] significant interest—and PCAST did do work, particularly under [Bush, '43]. But [. . .] the *Gathering Storm* study was requested by Congress actually.[2] It didn't come out of the White House. It was both the House and Senate [and] bipartisan, believe it or not, if you remember what that means. They asked the [National] Academies to put together [a] group to take a look

[2] Committee on Science, Engineering, and Public Policy, *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* (Washington, DC: The National Academies Press, 2007).

at [America's] competitiveness, and that was during the period when the world [was] no longer flat—people losing their jobs to India and China. It was a headline kind of issue. That was done with the National Academies [. . .]—and I'm thinking hard whether it's appropriate to mention this, but I will do so—we had great access to the Congress. [The] Congress asked for the study and [we] knew a lot of the key people. [. . .] For example, one evening the Senate had a dinner so I could present the results [of] the *Gathering Storm* study. Over a third of the members showed up at this dinner, which, I mean, is unheard of. If we went to war, we couldn't get that many [to an evening meeting]! Anyway, that was a great evening; they asked questions and so on and then went back and wrote legislation.

But this is very ironic. We were never able to get our briefing [directly] to the [President. Ironically], it turned out that the roadblock was the president's science advisor. I want to be very careful because he no longer is with us, **<T: 130 min>** but why he was [thus] motivated, I don't know. The only thing I could think of is that he [thought that it] should have been his job to [lead] that study, not for the Congress to have asked for it. I don't know. That's [. . .] the only thing I could think of because [he was] a very capable, good guy. Anyway, he was a roadblock, and we could not get on the president's calendar. [Fortunately], some of us knew people like the Vice President pretty well and others that were [on the] President's senior staff. We had no trouble getting to see the President, but it meant going around the science advisor. And when we did, we knew we would pay for it, but we also knew that if we didn't do it, we weren't going to get [. . .] the administration to follow up on [our recommendations]. The Congress was ready to go. [Anyway], we got an appointment with the President and a couple of us [briefed him. The] President agreed to feature [our recommendations] in some speeches.

It turned out that a week [after we submitted our report he was scheduled to give three days of speeches in the] Western United States, which he adjusted and made a major part of those speeches [. . .] about competitiveness and science and engineering. [I remember going to New] Mexico because he invited my wife and [me] to go with him and his wife to hear the speech. He put a lot of effort into it. [. . .] Then he left [office] not long after that. [It] would have been President [Obama] after that, who really picked up on the topic and was terrific. You mentioned [. . .] the president's State of the [Union]. I had made a remark on the spur of the moment, which I probably shouldn't have [. . .], at a hearing, which his staff apparently heard [and included in his speech. They didn't attribute it or anything. It was about science. So, the word was getting around]. Of course, we did get a couple big [increases] in the budget, but they weren't sustained, which was the problem. One of the difficulties, as you know from your background, is that there are not a lot of people on the Hill that are involved in science or engineering or business policy. There are very few business people there; [fewer scientists and engineers].

Occasionally a [Hill] staffer would show up at a PCAST meeting, but that was pretty rare. And that brings to mind another funny story that probably I shouldn't tell either, but there's nothing secret about it; it was a [PCAST] public meeting and it was on cancer research. [. . .] At the end of the meeting, sitting behind me where the public was, a young-ish guy—thirty-five, very pleasant—came up with a broken accent and gave me his card and said he was from the Soviet embassy—military attaché—[. . .] they were very interested in the work [we were] doing

on cancer research. I said, "[. . .] I don't know anything about that. I'm a member of this group, but that's not my field." So about two weeks later I get a call from the Soviet [embassy] . . . my secretary gets a call that this individual would like to come and talk about how we do research in America—cancer research and other kinds of research categories—who approves it, how it gets done, and so on—very unclassified stuff. Of course, I'm skeptical as the dickens of this; the red flags were flying all over. [. . .] I asked the security people, "Should I talk to him?" I didn't want to be discourteous, [but I was very suspicious. They] said, "Sure, talk to him, but don't say anything." I talked to him and didn't say anything. We had a very pleasant discussion on some of the better Russian restaurants [. . .] in Washington and so on, minor questions about the Congress's role in putting together the research budget. Totally innocuous discussion—a waste of both our time. So, he left—very thankful—I didn't think any more about it. About a week later, the **<T: 135 min>** FBI calls and said they'd like to come [and] see me. They said, "[Do] you know who this guy is that you're talking to?" I said yeah. They said, "So what did you talk about?" I said, "We talked about Russian restaurants and the budget process; [. . .] how it originates in the House and goes to the Senate and goes through an appropriations and authorization [committees]—stuff they teach in third grade." They said, "Well, if he calls you back, let us know." He never called back. That's [another] PCAST story. Weird.

CARUSO: Kenny, do you have other questions about time on PCAST?

EVANS: No, I think that that's good. I mean, I'd wanted since, you know, we were curious like Dave mentioned and I think Norm did a good job explaining this—the ebbs and flows of between when PCAST is utilized and how much of a voice it has in policy decisions. So no, I think I'm good.

AUGUSTINE: You know, I think a big difference in retrospect—we talked a little about it—is that there was no sub-organization; it was a very flat organization—PCAST—and, secondly, that the PCAST had no staff of its own. It was served by the staff of the president's science advisor or OSTP [Office of Science and Technology Policy] or whatever, whereas the Defense Science Board had its own staff and we could create our own studies and go off and do them. Sometimes they—[the Defense Department]—didn't like us doing them. On the other hand, they tolerated [it] because we did enough that they wanted to hear, that [. . .] they were interested in, but we insisted that one of our roles was to be able to tell them things they didn't want to hear—and we could do that. We had ample staff; there were usually the equivalent of a Navy commander would be the chief of staff, and there were three or four or five other people—military and civilian. So we were well-staffed [in] getting things done; logistics were easy. Whereas PCAST was much more of [. . .] academically focused. It reminded me more of my time at Princeton teaching than it does of my time in the rest of the government. It's, kind of, a strange parallel, but it does [fit].

EVANS: Yeah, that's interesting. PCAST has always had kind of a bare bones staff; they have one or two, tops, kind of, executive secretaries. Do . . . is that something that in terms of recommendations for if PCAST were able to make more of a sustained . . . if there were . . . PCAST in some sense—I'm asking, kind of, a leading question, but PCAST is to function better, should it work more like the Defense Science Board in what you're saying where there's a dedicated staff and, kind of, a dedicated purpose. Or is the academic nature of PCAST a benefit in some way?

AUGUSTINE: Well, [that] certainly is a benefit. On the other [hand], the Defense Science Board was probably half people from academia, [. . .] and in terms of the impact [. . .], PCAST, plugging in allegedly to the President, should have a lot more authority or impact. But within its sphere, working for the Defense Secretary, the impact of the two organizations were orders of magnitude [apart]. The Defense Science Board was far more impactful. I could walk in and see the Defense Secretary [as if I were] on his staff when I was [chairman. You could] do that as a member of the Defense Science Board, and [the Secretary] would come to our meetings and his deputy would come to our meetings occasionally. [It] may be true of PCAST, but I don't think it ever was. [Whenever] PCAST changed . . . no, this isn't true—let's see—I served on both; I was chairman of the Defense Science Board [and] started under [a Republican and ended under a Democrat]. You just continued [on. There] was no automatic, "Look, [. . .] we ought to be changing [membership]." Whereas with PCAST, the chairman would be highly [unlikely to stay. I] **<T: 140 min>** think that there were two of us [members who] stayed on at one point—not many. But it was a turnover on the political cycle.

I do recall on one occasion [when] I was chairman of the Defense Science Board, we got a call from the Office of Presidential Personnel that they had three people they wanted to put on the Defense Science Board—none of whom had [a background in science. I] said, "The one thing I can promise you, [. . .] if you put those three people on the board, which you could certainly do, [. . .] you should advise the President the entire board will probably resign." So they didn't do it; there was that much of a difference. I guess what I'm saying is that there was a [. . .] more partisan flavor to the PCAST than there was to DSB, whatever that's worth. I think that PCAST played an important role but wasn't as connected as well as it might be. I think the effort demanded of the members was less than [. . .] was demanded of the Defense Science Board members—although probably the PCAST was a little bit more senior than most of the Defense Science Board members. But that [cuts] both ways.

EVANS: So this is, kind of, more of a—I don't know—general question, but since you were chair of the Defense Science Board, if you were chair of PCAST, would there have been things that you would have done differently over the sixteen years—both in the Clinton administration and the G. W. Bush administration?

AUGUSTINE: No, I was only a member of PCAST, never chair or anything, so my role was very different. I think both were competently led, putting myself [aside. When] others were

chairman and the Secretaries of Defense changed, the interest level varied. [. . .] Secretary of Defense Harold Brown [had run] Livermore Lab [Lawrence Livermore National Laboratory]. Bill Perry was secretary; he was an engineer. There was a lot more [. . .] normal connection between our [group and the person] to whom we reported than there is with the PCAST reporting to the President. But of course, the President has a lot more to do than the Secretary of Defense, so you would expect less connectivity. [. . .] I don't know that the PCAST is denied creating its own studies. I'm not familiar with any, but I suspect it could have, and I'm sure that the president's science advisor created studies that [. . .] the President didn't necessarily ask for. But the DSB, not infrequently, did study topics [that] bubbled up from below.

[One thing] I remember was [about] Johnny [John S.] Foster, whom you may [remember. Johnny chaired] for the DSB a study on high-energy lasers [used] as weapons. I'm quite sure that question would never come from [. . .] most Secretaries of Defense; somebody [else] out there. Johnny, in particular, was involved in seeing that there's a real potential for these things. [. . .] Other times we'd get involved in things that were cutting across services. [That] was true also of PCAST, where I think it served a value—[cutting across departments. There was an issue between NASA and NSF and one other] organization I can't think of now, but cross government, **<T: 145 min>** where OSTP or the PCAST [was] ideally suited to step in and give an independent view of how to deal with [the issue. There] weren't many of those, but that would be one. There's so much [in science and engineering] that cuts across government. I'm thinking of some of the issues I'm involved with right now that involve huge pieces of the government and there's really no referee, other than the President**,** to deal with them. In science or technology, the normal referees the President would turn to, you can count on one hand. [. . .] Well, anyway, that's just an observation.

I'm a huge fan of PCAST. I wouldn't have spent so much time with it if I didn't think it were [useful. For] that to happen, the president's science advisor has to have more clout. The problem isn't with the individuals; most of them, [are] highly qualified. It's just that—[. . .] I'm giving myself away here—[. . .] science and technology plays a role that's so huge that it deserves more attention in our government. If we're going to solve climate change, lawyers aren't going to solve that. It's going to be scientists and engineers. If we're going to win the next war, we're going to be outnumbered four to one or more, it's going to be engineers that solve that. If you're worried about COVID-19, it's not going to be lawyers to solve that. It will be scientists. [. . .] And if you want to improve the economy, 85 percent of the economy comes from breakthroughs in science and technology. But when you look at the structure of our government, you would never detect that.

EVANS: You would you had mentioned earlier your recommendation for creating a Department of Homeland Security. Do you also feel like there's a need for . . . . I know they are separate issues . . . but the same kind of department level for science and technology or innovation? Is that something that has crossed your mind or you would recommend?

AUGUSTINE: [. . .] I've thought about it a lot, and it's a really hard question. My initial reaction, of course, is yes, anything important you ought to have a department in charge of it. The problem is that [science and technology permeate every piece] of the government. The Department of Transportation, the construction of bridges, air traffic control, the Department of Health, the NIH. The Department of Energy is mostly science and technology. It makes so much sense, but I've ever been able to figure out a way to do it. It's like saying we'll have—well, we do obviously—it'd be like having a department of money because everybody uses money. We do have a department of money, and we have a Department of Justice—[but], hopefully there's justice in all of our other departments. [. . .] This one strikes me as too hard. [I] have an open mind; if somebody's got an idea, I'd love to hear it. I don't have it. But it does seem to me that there could be a greater role for the Office of Science and Technology [Policy], for the president's science advisor, for the [PCAST. The military] has a lot of people; it's responsible for a lot of missions, but it also has a department that's in [overall charge of research] and development. It has a science board. It has a lot of engineers, scientists working there, whereas the top of our government, there's not. Of course, up until recently, China was run almost entirely by engineers—[so would that be good or bad]?

One time I had a meeting . . . . I don't think I mentioned this to you [. . .] but I happened to have a meeting not dealing [with my government affiliations], but with a corporate board I was on—not Lockheed Martin. I had a meeting with the President of [China. When] he found out I was an engineer, all he [wanted] to talk about was engineering and how you train engineers, what you do for engineering shortages, and how you get young kids interested in engineering. Our robotics programs—how do they work for kids? He didn't want to talk about the business issues I wanted to talk about. He **<T: 150 min>** was a dyed-in-the-wool engineer. That's never happened to me in this country; not once. [. . .] I think if more [engineers could help] run the world, it would be different. We would solve [problems].

[Just to wrap up the story, when I retired . . . there's] a moral to this story in addition to being kind of humorous . . . the first call I get [. . .] was from Bill [William H.] Frist, who was Speaker of the House at the time. Bill wanted to set up a Base Closing Commission, which has to be absolutely the worst thing to work on in human history. I mean, you [have] to be suicidal to agree to do that. He wanted me to serve on it. Believe me, I didn't want to do it. I had just retired, and I have all these hobbies I was thinking I was going to work on. So I get a call from the White House . . . I [had told Bill] I'd do it. So I get a call from the White House and they said [that] in going through [my] sixty-two-page form of [. . .] conflicts—potential conflicts—that I'd submitted, [they see that I] own Lockheed Martin stock. By now, I had sold it because of other [pro bono things I'd been asked to do for the government]. I sold my stock. Terrible mistake! And they say, "We see on your form you have Lockheed Martin stock." I said, "Well, that is true." [. . .] They said, "How much do you have?" I said, "One share." They said, "How much do you make?" I happened to remember at that time, it was [about sixty-three cents per] quarter. And if I sold the shares, I think it was like thirty-four dollars or something like that. The person I'm talking to in the legal office—the White House—said, "Well, that's a big problem." I said, "You mean, you think I can be bought for sixty-three cents a quarter?" I said, "You'd make my wife very happy because I have to pay thirty cents tax on that, and it costs forty-three cents for her to deposit the check in the bank. It's costing me money every time I get one of

these." [. . .] They said, "Well, this is a problem." What is it called? The perception of [a potential conflict of interest].

So I call [the people at Lockheed Martin [. . .] who manage the shares. [. . .] "I've got a great deal to offer you; it costs the company five dollars a year to send me my sixty-three cents check each quarter and to send me a copy of the annual report. If you'll quit paying me my sixty-three cents a quarter, you won't have to pay any of those expenses to handle me as a shareholder anymore." So they said, "Okay if you want to do that, fine." Then the SEC steps in and says [to Lockheed Martin], "We notice that there's a person—a shareholder—that you're not sending [. . .] dividends quarterly. You [have to pay the person] if he owns a share." And so I go back to the government, "Sorry, I can't . . ." Anyway, I never served on that commission. [. . .] On commissions, the same thing came up every time. But every time [I appealed]. I have these letters [with] sixty-three signatures of lawyers saying that they don't think I can be bought for sixty-three cents. I still have a share. Oh, the reason I have that share . . . they said, "Will you sell the share?" I said no. They said, "Well, why won't you sell it?" The reason is [it is] hanging on my wall; [. . .] it's share number one of Lockheed Martin. [It has] my signature on it, having authorized [its] issue. I'll never sell [it. Incidentally, it's] worth two hundred dollars now, so it's a big deal. Anyway, that's the kind of nonsense you run into doing these [things. It] just makes it harder than it has to be. [These should not be] hard problems to solve.

[Anyway], since I've retired. My secretary looked [this] up the other day when she was submitting another Form 5 or whatever it's called—[. . .] I've chaired or co-chaired thirty-nine committees or commissions [mostly] for the government in the twenty-three years since I've retired. That's about all I do. Totally pro bono. And it's been for me the greatest experience working with the best people in the country on various subjects, [. . .] learning **<T: 155 min>** so much, and hopefully [making] a contribution. It's just been like going to graduate school for the last [twenty-three] years. [That's] kind of the end of the story. I have no regrets. Very few. No big ones. It'll be funny to hear from Neal Lane whether he thinks he and I served on the same PCAST together or not.

CARUSO: Kenny, do you have any other questions? No?

EVANS: No, I'm good.

CARUSO: Okay. Well, I mean, it's almost six o'clock my time. So we're pretty much at the end of the session. I know that you spoke a bit about . . . . I mean, looking at your CV, your resume, it was quite clear that retirement for you didn't mean that you're going to stop working. In some respects, you seem to be doing even more than when you're running a company. You know, with oral history interviews, we always want to provide interviewees with a chance to discuss things that maybe we didn't ask questions about, to go down other paths that we didn't necessarily go down in greater detail. Obviously, we don't have the time to do that right now, but if there are other things that you want to discuss, I want to make sure that you know if we

need to set up another session—even if it's a shorter one or something like that—that we do that because I don't want to cut your story short, just because the interview session was . . . is ending now.

AUGUSTINE: Well, there's just one thing that pops into my mind, and we've talked about it but it's so important to me, and it's particularly important today. That—what's the word?—[prestige. If it is not] assigned to people who work in our government—particularly the career civil [service], but not just those—[also] the presidential appointees—[most], not all, are some of the hardest working, most capable people I've ever worked with. And I've worked [with] a lot of different companies [at] various levels. The people I had the privilege of working with [in] our government not only should be higher paid but they deserve a lot more credit for what they do. [. . .] Matter of fact, I helped . . . played a tiny role . . . in starting up an organization when I left the government that's turned out to be very effective. I don't have anything to do with it anymore—to try to honor people who serve in our government . . . but they only honor a [handful. That's the message I'd like to leave]: that there's a huge disconnect in this country. Sure, there's some people in industry that aren't the greatest [and] some in government, [too], but the overwhelming majority of people I dealt with in government—civil servants and most presidential appointees—were very dedicated, capable people. I guess I'd like to get that on the record as somebody who spent ten years in government, thirty years in [. . .] industry, and [several years in academia in one capacity or another].

CARUSO: All right. Well, thank you very much for your time. You know, as you may remember from when we were . . . before we started, what we'll be doing is we're going to be transcribing the interview. And once that's done, we'll be sending you a copy if there are things that you think need to be added, there's time to add it; there's room to add it. And as I said, you know, if there are things that come to mind and you think that there are a couple more things I'd like to discuss, we can always schedule another session to capture that information as well.

AUGUSTINE: Okay. Well, as you can tell, I've enjoyed it. I haven't had occasion to sit down and talk like this about what's happened in the past, and I am working about as hard as I [ever] did; I don't have as big a staff as I used to have at Lockheed Martin, but my secretary and I are pretty good together! So [. . .] thank you all. It's been a pleasure visiting with you, and I hope I haven't bored you to death. I look forward to continuing to work with you on some of the [. . .] things we all care about.

CARUSO: Well, thank you very much for your time. [. . .]

[END OF AUDIO, FILE 2.1]

[END OF INTERVIEW]

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