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**TAFT BROOME:** Miss Ratliff is going to give us a review of the safety seminar. And then, I want to carry on a discussion about safety. And then, I want to start introducing more about the narrative approach at the end of class. And I'm going to talk about-- I'm going to give a short narrative of a film that I saw this past weekend. All right?

**AUDIENCE:** Found to be adequate, but they just went ahead anyway with testing and just approved it. So what they think happened is the joints of the engine gave way. The engine flooded. There was spray on the switchboard. And a lot of electrical problems occurred which resulted in the loss of propulsion. They were unable to blow the balance tanks and the submarine was lost.

So one of the conclusions they came to, or that there were many deficiencies. There were deficiencies in the shipbuilding and the maintenance. There were not enough records. No one really knew what had been done to the sub. No one knew what test had been done because the records were really poor. And there were also problems with the operational procedures.

So SUBSAFE was created. And his goal, I thought of our code of ethics discussion, the goal of SUBSAFE is to provide, and I quote, "Maximum reasonable assurance of two things, hull integrity and operability and integrity of critical systems." So that is the goal.

And it's very-- it's almost very rigid. going back to what we're talking about in the hall. But that is the purpose of SUBSAFE. They don't worry about weapons. They don't worry about the training of the crew. All they're concerned about is keeping the hull intact and the critical operation of things on the sub intact. And that's where they're going.

He started out, this first slide was actually the quote from George Santayana, "Those who cannot remember the past are condemned to repeat it." And one of the first things he talked about is a big part of safety is boring. It's doing the same thing over and over. It's checking twice. A lot of it's really dry. And that's the culture there.

And he talked about the difference between NASA culture and what they had at SUBSAFE. He was saying how they have this massive benchmark exchange. And one of the differences that people from NASA say is you guys at SUBSAFE emphasize your failures. We don't feel the need to do that. He was saying that's a really, really important part of safety at SUBSAFE, looking back at past failures, going over it again, and again, and again, double-checking, and it was just really something that's embedded in the culture.

So another thing that he talks about is you have this goal in mind is to provide this assurance to the hull integrity and the critical systems. He drew what he called the SUBSAFE certification boundary. And so again, along the same lines, it was interesting. I think they have probably some analogies to ethics that we can make. But he definitely drew a clear boundary around this area that he is only concerned about everything else is not his problem. I thought that was interesting.

He also talked a little bit about the organizational relationships, how their program managers who are only concerned with cost and schedule, and how there's an independent technical authority that is not really part of the managerial process. They have to OK and they are completely separate.

Maybe I'll draw a diagram if you guys want to see. But just in terms of the way the organization is structured, that's something that is unique. When you compare it to especially something like NASA, the technical leaders have a certain amount of independence because they know, they'll go and set the standards independent of what the managers say.

Everything that they do, this is another interesting point I want to bring up, is based on objective quality evidence. I think OQEs have-- I don't know if they refer to them that way, but that was the abbreviation he used. And all of their observations can be tested and have to be verified. And so, this has direct, I thought, linkage to what we were talking about when we were talking about knowledge and how you get to truth.

But for them, it has to be able to be tested. It has to be able to be verified. He made the point that honest mistakes will kill you just as fast as any other mistakes. It doesn't matter if you think you did it. You can be a great person. But unless you work-- and if I can double-check, and test it, and verify, he's not going to go with it, which I thought was a really interesting point.

Another interesting point I want to bring up-- I'm really summarizing. Because this lecture was 2 and 1/2 hours.

[LAUGHTER]

[INTERPOSING VOICES]

**AUDIENCE:** I forgot to mention that part to you, [? Krista. ?] So I'm not going to go through all the nitty gritty details. I'm just picking out the parts--

**AUDIENCE:** Doing great.

**AUDIENCE:** --that I thought were interesting. He said something at the end that organizations such as SUBSAFE have to guard against three things, ignorance, arrogance, and complacency. And we saw a few videos, one from a challenger, one-- I don't know where that oil rig was. Do you know what--

**TAFT BROOME:** No, I don't know. Mm-mm.

**AUDIENCE:** --that actually, I guess, tipped over and sunk into the Atlantic I think is what it was.

**TAFT BROOME:** Right.

**AUDIENCE:** But according to this report, those were the three things that we need to--

**AUDIENCE:** Ignorance--

**AUDIENCE:** Arrogance--

**AUDIENCE:** Arrogance.

**AUDIENCE:** --and complacency. And I guess people ask questions as to how SUBSAFE is able to navigate around those three things, and how it is that they haven't become complacent after-- I mean, I think it's been, well, since 1963, since the program was instituted, they never lost a SUBSAFE certified submarine ever. And so, somehow they've managed not to become arrogant, complacent, and stay--

**TAFT BROOME:** [LAUGHS]

**AUDIENCE:** Well, I don't know about the arrogant part. What do you think about it, Professor Broome?

**TAFT BROOME:** Keep going. You're doing fine.

[LAUGHTER]

**AUDIENCE:** So and it was just interesting. And for him, I think the key really was just to reemphasize these past failures, to go over again, and again, and again, so you don't get complacent, and to really understand why SUBSAFE was formed, and what it was about.

Doctor, I guess, Dr. [? Levison, ?] I think, he made a point about accountability and responsibility that might have to do with the military, which is another reason why this program might be so successful. She talked about-- was it the Challenger disaster she brought up that no one really was demoted. There was one person who got a lateral move.

**TAFT BROOME:** Oh, right.

**AUDIENCE:** But everybody, actually, pretty much involved was promoted at a certain point?

**TAFT BROOME:** I think that was-- excuse me, I think that was the Columbia.

**AUDIENCE:** Was it Columbia? OK.

**TAFT BROOME:** Because we've not had a whole lot to say that. [? Sheila ?] [? Widnall ?] was there.

**AUDIENCE:** Uh-huh. And that was another interesting point that in the military and within SUBSAFE, and maybe there's a direct link between the accountability and responsible. You are held responsible for everything. If you do something wrong, there's no way that you're going to be promoted. They're not going to overlook it.

And that might be one of the reasons they're so successful. Professor Broome, that's all I was going to talk about. I have a couple more pages of notes. Again, I could go on and on for a couple more hours. [LAUGHS]

**TAFT BROOME:** Well, let me see if I can't keep this off. They go on-- not for 2 and 1/2 hours,

[LAUGHTER]

That was 2 and 1/2 hours. That was 2 and 1/2 hours. He entertained all questions. But there was not a Q&A period.

**AUDIENCE:** I see. So who would stop asking a lot of questions.

**TAFT BROOME:** So he just continued on. And I'm not suggesting he was terse with any of the questions. But the lecture was not-- in other words, the 2 and 1/2 hours was primarily his presentation. And tell you what, let me make some observations. But I still want Miss Ratliff to be in charge of the discussion.

One observation is that welding-- when I knew welding 30 years ago and welding today, it's still primarily an art. And as much as you-- all four of us can take the same welding course, all four of us can get the same grade. But one of us is going to be a better welder than the rest of us.

And the only way you can know if the weld-- if my weld or if your weld is better than ours is to check it afterwards, which is expensive. Either tear it down and look at it, or they have these X-ray and other kinds-- I think it's X-ray, but other kinds of methods and sophisticated methods of telling whether or not a weld is good. So the only way that makes sense to check welding is, number one, is to make sure the people who do the welding are certified to do it-- highly certified.

And the second thing is to make some spot checks. And so far as I am concerned, the most important thing about spot checking is not the percentage spots that you take, just the percentage of your welds, and the percentage of your welds, and the percentage of my welds. It varies with the individual and it varies with the weather and other things in terms-- but welding is still an art form.

Concrete pouring is still an art form. [LAUGHS] Depends on-- now, that really depends on the weather and other things, a lot of other anomalies that you can't control. And there's usually one person on a big job that goes over and tests. Well, there are these people who go and get these samples of concrete and they test them after the fact. There's usually some old person who's been on hundreds of jobs that goes around and checks as the concrete is going in.

So this issue of the welding of the joints is not simply a matter of a technical matter. It's a personal skill level, art form. And few people that think--

**AUDIENCE:** How did that come into the [INAUDIBLE]?

**TAFT BROOME:** Because the Thresher failed at welding joints.

**AUDIENCE:** OK. I didn't hear that.

**TAFT BROOME:** And they had to set up standards for welding. And the main standards were too-- as I think Miss Ratliff said, it's the certification of the welder and the spot checks. You didn't use the word spot, I think, but you knew something about that you check a certain amount of the welds.

**AUDIENCE:** I was imagining bolts or something, I don't know, welding joints.

**TAFT BROOME:** Welding joints.

**AUDIENCE:** Yeah. And there is something-- I don't know if I mentioned that. But you're right, the welders and people who work on the sub have to go through the certification process also. So not anyone-- any welder off the street can get on and build a sub. There are only-- I think he said only two civilian--

**TAFT BROOME:** Yeah.

**AUDIENCE:** Ya'll understand it would need to be taken to [INAUDIBLE] certification. The materials have to be certified. And--

**TAFT BROOME:** Mm-hmm. And welding is dangerous. The most dangerous part of welding is not the obvious part. You think the most dangerous part of welding is handling heat and starting a fire or burning the operator.

When I was an engineer, one of the first things they do with a construction engineer is put them in charge of welding. And you don't know anything about welding, but you're in charge of welding. You're the engineer in charge of it.

One thing that you have to do is make sure the welder wears his mask. Because sometimes it'll be hot. They get arrogant. They think they can know everything. They take it off. And it'll burn the inside of their eyes from the inside. And I don't understand how that happens. But it's got something to do with something that's coming off of that weld other than heat and light. Some other rays or something that's coming out. So it's dangerous.

It's also dangerous in closed environments because you don't know what the oxygen levels are. The oxygen levels can be too high, or there could be some other chemicals in that air that could be dangerous. So that's interesting.

**AUDIENCE:** So and that is the root cause. And they talk a little about that when you investigate an accident, such as what happened with the USS Thresher. The Navy must get to the root cause. Where NASA does not necessarily. For example, everyone knows about the foam hitting the tiles on the wing. They still have not gotten to the root cause.

And Dr. [? Levison ?] was saying, it would be interesting to see if they will in fact launch in July because they're supposed to, and they still haven't gotten to the root cause. And that was a really important point, I mean, the joints. And they really are fairly sure that that is the cause that got to it. And it happened fairly quickly too. I mean, I thought it was interesting.

One of the immediate responses from the USS Thresher being lost was all Navy submarines-- this is during the Cold War-- were prohibited to go below a certain depth. And they did that without thinking about it. Because they really place such an important part in getting to this root cause, and understanding until they do, nobody was allowed to go below this level.

They set up a court of inquiry. They had to testify in front of Congress. And this was all, I think, just a couple of months after the disaster. So very quickly, they moved to figure out what went wrong. So that's another interesting--

**TAFT BROOME:** Oh, that's another point that I'd like for you to mention. The one where this nuclear sub ran into this mountain?

**AUDIENCE:** Oh, yes. And I guess, I think that was in January.

**AUDIENCE:** A mountain?

**AUDIENCE:** I don't know, I think it was January of last year, 2005, there was a sub that was, I think, off the coast of Guam somewhere and ran into an uncharted mountain. And apparently it was going at a pretty good speed and just hit head-on. And the sub-- the hull remained intact. There was one person who died I think later from injuries that were sustained.

**TAFT BROOME:** Well, the front of it looked like an accordion.

**AUDIENCE:** Yeah, it did.

**AUDIENCE:** Really?

**TAFT BROOME:** [LAUGHS]

**AUDIENCE:** Oh yeah.

**TAFT BROOME:** It was an uncharted mountain. They ran into it. I guess, I don't know how fast they were running. But--

**AUDIENCE:** They had to be going--

**TAFT BROOME:** 30, 40, 50 knots maybe.

**AUDIENCE:** Yes.

**TAFT BROOME:** That's about 20--

**AUDIENCE:** Yeah.

**AUDIENCE:** Sending--

**AUDIENCE:** Yeah, some kind of like--

**AUDIENCE:** --beams out into the water-- sonar?

[INTERPOSING VOICES]

**TAFT BROOME:** Just standing there-- I mean, suppose you're standing there with a hot cup of coffee talking to somebody.

**AUDIENCE:** Yeah.

**AUDIENCE:** That's true.

**TAFT BROOME:** The thing is running at 40 miles an hour. That's 30 miles an hour. And all of a sudden it hits a mountain. What does that mean? It stops. [LAUGHS]

**AUDIENCE:** Yeah, I know. I can't believe there weren't more deaths, or--

**AUDIENCE:** Yeah.

**AUDIENCE:** [INAUDIBLE] survive.

**TAFT BROOME:** Yeah.

**AUDIENCE:** Right.

**AUDIENCE:** But I can't believe it didn't like detect the mountain.

**AUDIENCE:** Yeah, I kind of think they would be sending sonar.

**TAFT BROOME:** Yeah. When you think that the satellites would have had all of that worked out, all of the-- I've got a map on my wall at my office. So big. And it has-- of course, it's two-dimensional, but it's a three-dimensional relief of the whole Earth spread out on a plane. And you can see the mountains and all of that. And so, it was done by satellite.

Well, each mountain, each mountain range is long. But each mountain looks like a little inverted V. And you can see-- I was thinking back when he said that. I could see how they might miss one. [LAUGHS]

**AUDIENCE:** Yeah.

**TAFT BROOME:** Ah!

**AUDIENCE:** So it survived though, because it was--

**AUDIENCE:** And they really saw-- yes, as a success because the sub was not only-- the hull was intact, but it was able to make it back to land on its own and power. And then we had to come get it. And again, the full front, right before it was smashed in, significant damage. But it was OK. So they resolved it as a success story.

**TAFT BROOME:** And that was in '73? 19 what? I mean, the Thresher?

**AUDIENCE:** Thresher was in '63.

**TAFT BROOME:** The Thresher was '63.

**AUDIENCE:** Mm-hmm. April 10, '63.

**TAFT BROOME:** So let's see, Thresher, I remember the Thresher. The Thresher terrified people, because it was the first time that there was a nuclear accident with a sub. It was a nuclear accident in the military that we knew about, I mean, that people generally knew about.

It was clouded in a lot of uncertainty. There were a lot of things that were kept secret about that sub. There were a lot of things that the newspapers said were kept secret that might not have been kept secret that there's just nobody knew about. So it was this cloud of distrust about that thing.

When I asked Mr. Ford about his opinion that on the one hand, the mission for SUBSAFE was a military mission. But the affected part is a particular-- potentially not just the environment, which he said was true. But all it told the general public, I mean, it's not just a case where there's a military accident that goes wrong and military people get hurt. It could be anybody.

And my understanding of his answer was that containment of the accident inside of the submarine was one of their missions. And that if-- that no matter how bad it gets, if it doesn't get out into the environment, then it can't hurt other people. So he did answer that question. Now, that has a moral dimension, because you're talking about the range of affected parties.

It also has this big possible question about affected parties that on the one hand, we can say that as citizens we take some responsibility for the Thresher. But if it's outside the 12 mile limit, and there are a lot of people who are not citizens, fishermen, and a lot of people, not to mention the environment, who were not parties to the decision but are affected parties or parties affected by what we do. And that becomes very international issue now.

In 1973-- '72, I finished my doctorate. And my dissertation was, guess what, on submarines. [LAUGHS] It was funded by the Navy. And my dissertation was on what you call a prolate spheroid. So you've got an ellipse that you rotate in its minor axis. And you get this football shape.

And one of the issues was hull failure. And we were looking at hull failure under pressure because you're talking about a thin shell. And a term of art for my area of the study was called shell theory. And the issue was buckling of this hull.

And before the hull would reach a pressure that would crack it or bend it totally out of shape, there was a failure mode that was much lower than that pressure in which part of the shell would buckle and was called snap-through buckling. That was another term of art.

And if what I mean when I say oil can, that you've got a can, it usually has a long spout like this. And you put that spout down in a machine where you want the oil to come out. And to get the oil to come out, this part back here is not flat. It's slightly arced. And you press it, and then it clicks. You get click through.

Well, you get the same thing with an empty beer can. You press it, and after a while you get it-- feel that click. If you let it go, it'll click back. That's called snap-through buckling. And we were looking at means of finding the critical load for that snap-through buckling. And we found that it would-- the buckling would actually occur in small little elliptical sections around the middle of the shell.

So we were interested in deep submersibles. And the Thresher was still alive in our conversations in 1972. So some of these issues bring back old memories that he was talking about. And let's see. Could you read again, please, Miss Ratliff, this mission, maximum reasonable assurance, blank, blank, blank?

**AUDIENCE:** Maximal reasonable assurance of hull integrity and operability and integrity of the systems.

**TAFT BROOME:** So hull integrity has to do with containing any accident-- nuclear accident within the hull as well as other things. So far as ethics is concerned, that containment means that the affected parties are only the soldiers.

**AUDIENCE:** Yeah. And I should emphasize what you probably imply, the nuclear safety people and the SUBSAFE people were actually separate. I mean, it's not the same, meaning that [INAUDIBLE] no responsibility [INAUDIBLE].

[LAUGHTER]

They have a healthy kind of something that goes on between them. But they're actually separate [INAUDIBLE].

**AUDIENCE:** The nuclear safety people are responsible for preventing accidents of the nuclear component?

**AUDIENCE:** Exactly, anything having to do with the nuclear technology that's involved. And that really is [INAUDIBLE] about hull integrity [INAUDIBLE].

**TAFT BROOME:** One of the motivations for the research we were doing was that they were talking at the time about making the hull one solid section, no welding. Yeah. Secondly, when it comes to military personnel on a nuclear sub, the only way you can get there, no matter what your rank, is first of all, to volunteer. You cannot be drafted.

The second thing is that all of the officers in the United States submarine-- nuclear submarine service until Admiral Rickover's death were personally interviewed by Admiral Rickover. [LAUGHS] Personally. So you can say what you want. But in the end, I think that says something about selectivity. Because that was a-- he had a reputation for-- well, his reputation is best described by words that I would not use in this class.

[LAUGHTER]



But words that if he were alive, he would not object to. [LAUGHS] But so it was very selective. So the point is that a moral issue is that all of the people serving on a nuclear sub are volunteers and are people who are well-equipped with the technology.

**AUDIENCE:** I think another interesting ethical issue is, I just thought of [INAUDIBLE] Professor [? Widnall ?] made the point that astronauts are-- there are people who have this mentality of let's go where danger is. And you're saying, these are not risk averse people.

**TAFT BROOME:** Right.

**AUDIENCE:** These are people who are adventurers, and they want to go to space. They train their whole lives. It's so hard. It's so competitive. Most astronauts don't even get the chance to fly. And so, safety standards are different. And you don't maybe expect [INAUDIBLE]. Instead, these are people, they're not under [INAUDIBLE] necessarily either.

These are people who just-- they're not like military trained, they don't have this-- they have a different mentality and want to go to space, and want to fly, that they're-- and it's OK to relax the standards a little bit for them. And it's just something that I thought about. I thought it was interesting. [INAUDIBLE].

**TAFT BROOME:** Oh yeah. Because what this does is it-- you all probably this movie by some of this repeats and some of it's *Alien Two*, *Alien Three*, how many do they have? Six or seven of them?

**AUDIENCE:** I've never seen it. But, like--

[LAUGHTER]

**TAFT BROOME:** You've never seen any of them?

**AUDIENCE:** No.

**AUDIENCE:** Oh, come on.

**TAFT BROOME:** Count yourself lucky. [LAUGHS] *Alien*, I'll never forget. The first time I saw *Alien* was in a movie theater in New York City. One of the things that I'll never forget about *Alien* was that I was standing in line to go in. As the people were coming out, I'll never forget the looks on those people's faces when they came out of that movie.

[LAUGHTER]

I wasn't too sure if I wanted to go in there. But the thing about *Alien* that makes a big moral issue for a class in engineering ethics is that it was the first, I think it's fair to say, the first popular scientific-- science fiction movie made where the expedition was not done under the auspices of somebody's government. It was a private corporation. [LAUGHS]

So that changes everything. Because how much have the rest of us participated in their ethical and their safety standards and all? Well, we can say they have to pass government standards. But 100 million miles out, bringing stuff back that nobody ever has seen before, what are they going to do? They're going to-- well, the point I'm trying to make is that this movie *Alien* I think is a real contrast in ethical stances with what we see here in the Navy.

*Star Trek*, if you remember, that was military. All of these others somehow government slash public-sponsored trips if not military trips or expeditions, even by the aliens. Even by the aliens. *Alien* came out and it was business. If you ever see this movie called-- or the first one called *Predator*. You saw *Predator*? How many of them?

**AUDIENCE:** Just one.

[LAUGHTER]

**TAFT BROOME:** Which one? The first one?

**AUDIENCE:** The first one.

**TAFT BROOME:** I haven't seen it enough times yet, *Predator*. But *Predator* introduces another dimension that follows up from *Alien*. And that is, this was a private expedition. People out on a hunting trip from another planet. But it's not government. It's not business. They're out on a hunting trip. And so, who controls their potentials for unleashing lethality on the rest of us just by merely exploring space. Who knows what you're going to bring back. [LAUGHS]

**AUDIENCE:** Well, now we have those questions in America, because there are private space exploration companies. There are several entrepreneurs who are--

**TAFT BROOME:** What are they-- a space trip?

**AUDIENCE:** Mm-hmm. Now it's sub-orbital.

**TAFT BROOME:** OK.

**AUDIENCE:** You go and-- but there are several companies that are working on [INAUDIBLE]. You pay for it. That's--

**TAFT BROOME:** How soon are we--

**AUDIENCE:** Their safety standards are of question [INAUDIBLE]. Yeah. Don't have to--

**TAFT BROOME:** Have they started-- have they had any tours yet, or are they--

**AUDIENCE:** I should know this. Has anyone gone sub-orbital? I don't think anything has gone up yet.

**TAFT BROOME:** But it's microgravity though, is that true?

**AUDIENCE:** Mm-hmm.

**TAFT BROOME:** All right.

**AUDIENCE:** And then there's microgravity flights on planes that fly [INAUDIBLE] started too.

**TAFT BROOME:** There was a company I know about. And I only know it-- let's put it this way. I know about it from I guess, I wouldn't call it gossip. It was common knowledge, let's put it that way, among NASA employees where this company presumably had gotten licensed to bury you in space. And if you wanted to be cremated, they put your ashes in orbit. [LAUGHS] They claim. I don't know if they're doing it. [LAUGHS] But yeah.

So but that was-- I'll call it common knowledge. I call it common knowledge because everybody said so. I mean, this wasn't-- I mean, you'd get up to a presentation given by the NASA assistant director, they'd mention it. That kind of stuff. But I never saw actually the proof. [LAUGHS]

Yeah. Let's go back a second to what [? Widnall ?] said and what [? Levison ?] said. And that is especially with these astronauts. I don't know if what they said applied to [? McAuliffe. ?] I believe without question what they said about all of the rest of the astronauts, that if it was left to them, there would be no safety standards for themselves.

And I can see the point to that. If I was an astronaut, I would feel pretty much-- I would be what they call-- what the Marines called gung ho. I'd want to go. Stop me from going with all of these rules. But [? McAuliffe ?] brings in a whole new factor because she was not a military-- was ordered-- and then she was picked out of a pool of people of ordinary people.

**AUDIENCE:** But she did choose to go.

**TAFT BROOME:** She chose to go. But she was still not trained to die for this stuff. She might have been willing.

**AUDIENCE:** But she wasn't part of the culture.

**TAFT BROOME:** No. And the whole point of NASA taking her on board was to sell NASA to the rest of us.

**AUDIENCE:** Right.

**TAFT BROOME:** So it would have been counterproductive to get somebody who was as gung ho as the rest of them. Because the rest of us are not that gung ho. Let's see.

**AUDIENCE:** There's another point about--

**TAFT BROOME:** We're not going to go on for 2 and 1/2 hours.

[LAUGHTER]

**AUDIENCE:** No. Just one thing I thought was interest that if the world [INAUDIBLE]. He did make a point about cultural differences. And how when he went to Asia, there's this whole attitude of don't shout, don't challenge. And part of what he does is he double-checks on what you do. OK, you said you did that. Well, you know he'd be right behind you checking to make sure that we can test this, we can verify.

And in Asia, it's a different culture. People know how to respect and say, oh, did you do that? And they take your word. And it's considered disrespectful to go back and double-check and say, are you sure you did it? And again, he just made the point, it could be an honest mistake. But it can still be a mistake. So that was interesting, saying that maybe it was cultural differences make it different.

**TAFT BROOME:** Yeah. Cultural differences, one thing is for sure that I've experienced myself, and that is I've been in other cultures where people would defer to my age. You don't get that around here.

[LAUGHTER]

Well, now they do. It was about a year ago I noticed that young ladies would hold the door for me when I would go into a building. [LAUGHS] But now there was a big change in America. I remember going to a lecture, going to a conference. I went to this conference. I went to two conferences where I was pretty much the only male in there. One of them was called--

**AUDIENCE:** Must not have been an engineering conference.

[LAUGHTER]

**TAFT BROOME:** Actually, it was. Yeah. One of the, yeah, I'll tell you about this one. It was called breaking the glass ceiling.

**AUDIENCE:** Oh.

[LAUGHTER]

**TAFT BROOME:** And all of the speakers save one, maybe two, but definitely-- were women who had made it in engineering.

**AUDIENCE:** Right.

**TAFT BROOME:** And all of the rest of them were not so much women who were trying to make it but women who wanted to write about making it. And a lot-- and it was sponsored by people-- it was sponsored by what they called the National Engineering Foundation. And the proposal was written by women, many of them who were involved in engineering ethics and this kind of thing, engineering public policy, STS people.

And as a matter of fact, they had this conference up in Canada at a ski lodge. But it was in the summer. And so, I went in to register. And it was-- they had plenty of money. They were putting everybody up in condos. And it was only two people to a condo. And you're talking about two floors of condo. Really nice places. Let's put it this way. Much better than the Hyatt.

And they put me in this condo. And they said, you'll have one housemate. I said fine. I said, oh, by the way, do you know my housemate is? They said, we'll look it up. And they looked it up and they said, oh, yes, I don't know what her name was, Sheila McGee or something. I said, wait a minute. I said, [LAUGHS] I can't go in there with this lady? And the people who were at the registration desk stood up, put their hands on their hips said, how do you get to be so special?

[LAUGHTER]

So, they went on up there. So I stayed on the phone with my wife. Anyway. But at that conference-- what'd I bring that up for.

**AUDIENCE:** Reference to age, I think?

**TAFT BROOME:** Yeah. The speaker got up, the main speaker got up and made a comment that-- the last session, the last presentation she had made was at a university. And she had to go through these revolving doors. And she said, only three students tried to run her down. And they hit a turnstile. Well, the revolving door. People laughed. But they weren't-- but in other cultures, there is still a respect for age.

And in some other cultures there is a respect for-- well, let me put it this way. There is a respect for position of authority. But not because you have power, it's because you have the responsibility and people expect that. And they don't like to overrule it. And I think that's what he discovered. Where was that? In Guam? It was in Southeast Asia.

And he was saying that people in different levels of authority would not challenge a person at a higher level of authority. But he gave the impression to me that corresponded with my experience, that it wasn't fear so much. It wasn't power-- an issue of power differential. It was expected if you have all of this responsibility, then I should respect you for that responsibility.

So whereas his job was really not to respect anybody. [LAUGHS] His job was to go in there and check everything, behind everybody, and find people at fault. So it was different-- difficult.

He used-- I just want to make two other comments. He used the word arrogance. My experience in these matters is that arrogance is, first of all, a very good word. But I think it's best understood as pride. Too much pride at being associated with the organization of the people that you're with.

And it turns out to be arrogance also. But there's a collective arrogance. It's not an individual arrogance. And proof, if you attack their organization, they get offended.

Any questions about what military people call-- since I was in the military-- any questions about what people call lines of authority accountability and responsibility?

**AUDIENCE:** I think I understand [INAUDIBLE]

**TAFT BROOME:** I'll give you one example that doesn't have anything to do. Well, it's not the military but what I brought-- when I was a Department Chair, I had an Assistant Department Chair. When I was away on travel, my Assistant Department Chair-- there was a faculty member that had a heart attack or something, couldn't show up for class. I was away for a week. Students are going to class and there's nobody there.

My Assistant Chair called up a person that he knew and hired the person to teach the class. When I got back, I had-- I knew this individual. And my attitude was that I had an experience with him that was potentially illegal if we had done it together. I told him I wouldn't do it. And I didn't want this kind of person standing in front of the students with power.

So I fired him. And he sued for defamation of character. And the University decided that it was in the University's interest to just settle. So and they took it out of my budget. [LAUGHS] So then the provost, wasn't called provost at Howard at the time, but same thing, provost, vice president for academic affairs called me in and said, how can we deal with this issue in the future?

And I said, well, in the military, we have something called authority, accountability, and responsibility. And I said, what we should do is precisely what you all have done. But you need to make a policy. And that is that as Department Chair, I was responsible for what happened. That means I am subject to punishment for what happens.

But my Department Assistant Chair was only accountable. That means he had to produce all of the evidence. But he did not-- but if he had done the wrong thing even, he does not go to jail, I'm the one who goes to jail.

**AUDIENCE:** So you're responsible, he's accountable.

**AUDIENCE:** So responsibility means subject to punishment for the action. Accountable means--

**TAFT BROOME:** Ability to explain it with facts. Explain the situation and to be able to support your explanation. So if you give somebody responsibility, then you also have to give them the power to exercise their responsibility, and that's authority. So the person with responsibility has authority. The person with responsibility can delegate authority to another person but cannot delegate responsibility.

**AUDIENCE:** And in the Navy, accountability directly corresponds to responsibility. So if you're accountable you'd be responsible for it? I think it was--

**TAFT BROOME:** No, you can have a subordinate officer, a person be accountable. Many times those are-- in the Army, they are sergeants. The sergeant knows more about what's going on in the unit than the captain does. So the sergeant is supposed to produce all of the facts.

**AUDIENCE:** So for SUBSAFE, that was the point that she was making, that SUBSAFE is unique in that accountability does go right along with responsibility.

**TAFT BROOME:** Oh, I see what you're saying. Yeah.

**AUDIENCE:** I think that's the point she tried to make.

**TAFT BROOME:** And she said it was unique.

**AUDIENCE:** Yeah. It was unique.

**TAFT BROOME:** Right, that a person with the authority and responsibility has accountability also. That's a-- I doubt if that will work a whole lot of different places.

**AUDIENCE:** Places, yeah.

**TAFT BROOME:** Because it's just too big. It's just too big. So when I was a company commander, I had another officer who was a deputy company commander. But I had a bunch of sergeants. And so, when stuff-- when I had to ask a question about stuff, I brought in these sergeants. Told them to lay down the facts. Then once they laid them down, I excused them. The officers would talk about it.

There's a big moral issue about in Vietnam called-- I think I covered it, My Lai. And I compared it to the Nuremberg principle. And the starting point of the issue for the military was that this was an officer. And that the officer was responsible even though his men did the shooting. [LAUGHS] The men were not responsible. But they were accountable. They had to come back and say what they did.

And as a term of art that I still understand is the case in the Army, check with some friends, but my last account was that even if your soldiers are half female, they're still called the men. And even if the commander is a female, you say, yes, sir. They still haven't gotten rid of that.

I think-- any other issues on this? Well, thank you very much, Miss Ratliff. If you want to have the last word?

**AUDIENCE:** I was just going to try to segue over into codes of ethics. Are we going back to that now?

**TAFT BROOME:** Oh, actually I had-- I wanted to tell this story. And there was something else I wanted to do.

**AUDIENCE:** The movie that you saw?

**TAFT BROOME:** Pardon? This movie I saw.

**AUDIENCE:** Yeah, OK, so--

**TAFT BROOME:** Wait a minute.

**AUDIENCE:** I'll save the codes of ethics if you have--

**TAFT BROOME:** Well, no, [INAUDIBLE].

**AUDIENCE:** Well, I just thought that what was interesting is--

**TAFT BROOME:** Go ahead.

**AUDIENCE:** --there's such a rigidity. I just really saw that they definitely have their code, and they have principles that they adhere to so strictly. And so, and it just tipped the ice what we were talking about with codes of ethics. And I just think to myself, is this good, morally allows for [INAUDIBLE]. I don't know.

**TAFT BROOME:** Yeah. One thing that we didn't discuss in there, and that was how does all of this discussion of safety work out in a combat situation? When clear the mission is now more important than the ship and crew. And all of the cases he discussed were peacetime failures. What happens in wartime?

**AUDIENCE:** Right. Because I would think that some of these rules would just get thrown to the side if they are in a-- if you're in a combat situation and they're pressed for time, I'm thinking to myself, how could they possibly do all these things that we say now.

**TAFT BROOME:** Yeah.

**AUDIENCE:** And there's nothing built into the system that would allow you to deviate one way or another from it. So that [INAUDIBLE].

**TAFT BROOME:** Well, frankly, I think the military makes it very clear, at least to their officers, the mission comes first. Now, excuse me, I'll tell you where there's an issue that is sort of in the gray area. And that's when you're at peace but in a Cold War.

Now, this situation was brought up in another film, a real situation. I'm trying to think of the name of the film. But it had to do with, recently, with this Russian submarine that went down. Even the Americans went over to try to save them. And the crew died in there. And there was this issue that they really didn't want the Americans to see their technology.

And a movie was made out of that, part fact, and part fiction, but got over the moral question I think very well. And I'm trying to think of the name of it. But I'll tell you who-- Harrison Ford starred in it. And he starred as a-- I'm not talking-- don't get it mixed up with the one that Sean Connery starred in. But it's the one that Harrison Ford starred in. He played the part of a Russian submarine commander. The one that Connery played in was--

**AUDIENCE:** One of them is [INAUDIBLE].

**AUDIENCE:** But I don't think that's the one he's talking about. I know the one you're talking about. I saw it. I just saw it.

**TAFT BROOME:** You know, yeah.

[INTERPOSING VOICES]

**TAFT BROOME:** Yeah. It was not as popular as the one that Connery played in. Connery-- his one was where the Russians had a piece of technology on this nuclear sub that was so effective that it could shift the power-- military power, one way or another in the whole world. And his basic idea was that no one country should have that technology.

Now, there's another story that I don't know if anybody ever made a movie of, and it doesn't need a movie, because all you have to do is just deal with the facts per se. And that is a man by the name of Niels Bohr, B-O-H-R, Bohr's Adam? Same name. When the United States was working on the Manhattan Project, Niels Bohr was a part of it.

Niels Bohr really irritated a whole lot of people, because he thought that the United States nor any one country should have the bomb. And he was making a lot of speeches saying that the technology ought to be made public. And he had already had the Nobel Prize. So it wasn't an easy matter just to shut him up. But that issue, is there something that's so powerfully destructive that no one nation should have custody of it or the knowledge about it. It is worthy of discussion in this class.

So and if you want to deal with it-- start with either with the fiction, either of these movies, or start with Niels Bohr and just deal with the facts. But they all bring up the same issue. So if you do see a movie like that, and you've got a five-minute presentation, five-minute, 10-minute Q&A, time for the class.

Codes of ethics. Now, then I'll make a mention that-- then I want to talk about this movie. The last thing I think I'm ready to say about-- actually, let's count codes of ethics now as a continuing discussion not as a module that we're going to be through with. From the standpoint of this class, let's see, we got visitors? We still have five, 10, 15, 20 minutes more.

**AUDIENCE:** Put a sign on the door.

**TAFT BROOME:** You're going to have to-- if you think that the term, codes-- that these codes of ethics are actually ethical rules, then my charge to you is to be able to justify that and to justify that on a rule by rule basis. Because a lot of these codes are not ethical codes.

I think they are best called codes of practice or professional practice, right, or guidelines. So one of them is actually called guidelines. They might even be statements of-- might be ideals.

**AUDIENCE:** Some of them are even contract-- it sounds like they're treated like contracts. If you're a member of this organization, this is what you will do.

**TAFT BROOME:** I think-- go ahead.

**AUDIENCE:** It's OK not to think of these as ethical rules. I think that's why the topic is bothering me, because I was trying to think of them--



**TAFT BROOME:** Yes. So I think that the term code of ethics is a misnomer. But it is a term of art. So you have to deal with that fact. It is any good encyclopedia would have that term in it. But as a scholar, you have to-- like I said, if you want to differ with what I said, then you're going to have to find a justification for it. But you just cannot take it as face value. That's my main point. You just cannot take that term as being revealing at face value.

I think also from-- and I think they have legal significance. But in a code-- in an ethics class, we need to think about them, I think, as ideals and/or guidelines for professional practice.

I want to talk about this film. Can I go to that now?

**AUDIENCE:** Yeah.

**TAFT BROOME:** And I give you the bad news first. I can't remember the name of the film.

[LAUGHTER]

Well, I tried so hard. It was a film-- it was a Tibet film in subtitles-- English subtitles. And they had the translation for the film. And I tried very hard to pronounce that word. [NON-ENGLISH SPEECH] is the best I can do with it right now.

But I think the film was called *Mountain Patrol*. It's in the newspapers. It's part true. It's taken from a true story that occurred in the middle of-- the early '90s, maybe '93 to '95, something like that. Where in Tibet, there is this antelope called the Tibetan antelope. And the pelt from the antelope is very valuable. And there were these Tibetans who were poaching these antelopes down to almost extinction.

And there were these Tibetan police who were after the poachers. And the Tibetan police, though they were authorized to go after the poachers, were not paid by the government. They were authorized but they were not paid. And the poachers were-- like poachers are today in Africa, they will kill a policeman.

So it's not just a matter of stealing it, you go to war with these people. So they had killed a whole bunch of policemen. And the policeman had killed some of them, a lot of them. So but the policemen who were out on this mission were completely, like the astronauts, completely dedicated to preserving these antelopes.

Now, I'll get to this one scene that sets up the moral issue. The film gets its energy, better stated, the point of view of the film is provided by a young man who works for a newspaper who goes up to the mountains to cover the story from the point of view of the police. You all might remember my-- did I tell you the story about Leon Dash, my buddy? Maybe not, this was another class.

**AUDIENCE:** I think you might have.

**TAFT BROOME:** And he went to Angola? I'll tell it at the end of class. But anyway, he goes up there to go with them. He knows the language because his father was Tibetan. So that gets over the language issue. But the rest of us in the film don't know, so it's subtitled. And he's riding around with them and learning all of the problems.

Well, there's this one scene where he's sitting there in this truck interviewing the captain of the police. And he learns from the captain that they had not been paid for a year. And so he says, well, how do you keep going? You've got to pay these men. You've got to feed them.

Where do you get-- you've got to have your weapons. You've got to have bullets. You've got to have gasoline for the trucks. How do you keep going? When they were able to catch any poachers and get the pelts, they would take some of the pelts and sell them back into the black market.

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** [LAUGHS] Look at that contradiction? You're there to stop the black market. But the only way you can end it, you think--

**AUDIENCE:** [INAUDIBLE]

**TAFT BROOME:** --is to participate in it at some level. They give the rest of it back to the authorities, the rest of the pelts. They only keep just enough to keep going. So the-- I said, my God. I was sitting there, how are you going to rationalize-- not rationalize, well, what do you do about a situation like that?

Because automatically, I could think a lot of adaptations of that problem to a lot of other problems in my own life, in politics today, in the class as a subject for the class. And but the conversation continued. Now, before I tell you the last part of the conversation-- it's almost like cheating, but let's do it anyway. I'll open the floor for anybody who might want to make a comment or ask a question. The last--

**AUDIENCE:** It's a very relevant situation, having to participate in something that-- yeah, and at the same time you want to bring a stop to it.

**TAFT BROOME:** Yeah.

[INTERPOSING VOICES]

**TAFT BROOME:** The only way to stop it is to participate in it. Yeah. I mean, when you say the only way, it's the only way you can think of, all right? Anybody else?

**AUDIENCE:** I think this goes back to what we're saying, because you can't really have that principle-- you can't go in there with the principle, the black market's bad, no matter what you do, it's horrible. And that would be your principle, because then you go to throw that away.

**TAFT BROOME:** Well, I haven't thought the matter through. But my inclinations are the same as yours. And that is that you probably could not justify this thing in terms based on principle. You might be able to justify it in terms of consequences, that the greater consequence--

**AUDIENCE:** Especially because, yeah, the animals have already been poached.

**TAFT BROOME:** You can say that.

**AUDIENCE:** Right.

**TAFT BROOME:** All right. OK, now bring in what I think is a very important part of this whole thing. And that is that the young newspaperman-- and it's important to say to young newspaperman, because the way that the thing was set up was that the young man met the captain's daughter. And you could tell they're falling in love.

So the young man says, well, if I write this article, you will go to jail for poaching-- I mean, you're participating in the black market. And he says, I don't see how I can write this. And the captain says, you have to write this article. And if I have to go to jail, so be it. Period.

**AUDIENCE:** Did the captain want him to write the article so that it would be made public that they weren't being paid, or [INAUDIBLE].

**TAFT BROOME:** Well, we can speculate. Now, I have the advantage because they gave me the character of this man. So I can extend out his character. But when it comes to the facts and all of this or the logic of it, we're equals.

But if I extend out this man's character, I think what he was saying to the young man is, you have to do what you have to do in this life. And I have to do I have to do. Doesn't mean that they're congruent. So be it. That's what I think he was saying.

And I think the movie laid out, at least for me, a sort of fatherly relationship. That's what you do with your son of your daughter. You have to do what you have to do, and I have to do what I have to do.

So that's the way that-- if it was laid out differently, if there wasn't an emotional relationship with them through his daughter, then you could say, well-- what really happened in real life was that the coverage by this newspaper man of what they did changed the whole situation around. Public opinion got out all over the world and the government had to pay-- not only pay them, but had to establish a larger force and do all of these other things.

So you could say that, yeah, the solution to the problem was not so much the black market but the public opinion. But the film set up a little bit of an emotional, and the characters made it work.

Well, this was significant to me for all sorts of reasons. But you're going to see this thing again. You've seen it once before. You're going to see it again next week. I talked about-- I think I talked about my approach to this narrative ethics, that in an engineering situation sometimes knowing what the right thing is regarded as really not possible at the time. You got to make up [INAUDIBLE] and make a decision right away, potentially lethal.

And the Western approach to ethics just will not work, because you're talking about doing the right thing one way or the other. And so, I came in with a more or less from left field, so to speak, with this idea let's not worry about doing the right thing. Let's do what we think we have to do, and after it's done hope that everybody will forgive us, basically.

Well, it seems to me that I have two metaphors for that attitude in Western-- in USA society. But this one provides another metaphor. Because it says that when I look into the character of the captain, then what he thought he had to do was something that even if he went to jail for, the Tibetan people would have some kind of understanding of and appreciation for.

And in American society, I say that Martin Luther King went to jail. Nobody ever said he shouldn't have gone to jail. But when he got out of jail, they gave him the Nobel Prize for it.

One that reaches more closely into if you have to deal with young Americans is that there's a good metaphor in basketball. It's called the good foul. It's a way of breaking the rules, making sure that the referee sees you break the rule. And after you have done-- broken the rule, the opponent-- your opponent will congratulate you for it, give you five, good move.

So that's what this is all about when I say that a break away from the Western tradition and borrow from some other traditions, you are really doing something that fits in with this captain, it fits in with Martin Luther King, it fits in with the good foul and basketball. And one of the chief features is public knowledge. The captain did not want to hide what he was doing. [LAUGHS] The good foul can only work if the referee sees you and calls you for the foul.

[LAUGHTER]

Martin Luther King's going to jail could only work if he went to jail.

[LAUGHTER]

He did what he did and he hid it and went out, it wouldn't work. He had to be caught. So a lot of things that people do that they try to justify as being the morally right thing is not going to fit in the category of what I'm talking about because they try to keep a secret. And that's where you divide the line. Do they want everybody to know or do they want to say, no, we're going to do the right thing and just not tell anybody.

That does not fit in what I'm talking about. So that when we do the narrative ethics next week, I want you all to have an intuitive feel for what I am trying to say that goes beneath what might be let out in our-- at a class, special class.