RSRM4

John Krige,

Interviewer

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Krige: Thanks for seeing me. I understand that you're a research engineer in combustion in the Aerospace Division. As I've explained to you, I'm extremely interested in how Georgia Tech respects and implements federal regulations of really two kinds, I guess, first the ITAR and the EAR, on the one hand, and, of course, NDA requirements, Non-Disclosure Agreements, on the other. I understand that you're the man who sits between the Office of Legal Affairs and some of the work in Aerospace.

RSRM4: Right.

Krige: So my real interest is how these cuts are made. I understand the non-disclosure agreement is, of course, written into the contract, so we'll deal with that separately. And, of course, I'm not interested in classified work. But it's the distinction between what is called the Fundamental Research Exception, on the one hand, and sensitive but unclassified knowledge, and then, of course, classified on the other side of that.

I understand there's two ways of making the distinction. One is through the sponsor himself and the other way is on the ground here when one looks at the project and compares the work that is done with various kinds of regulations. Can you explain a little bit to me that process and how it works, how smooth it is, where the pitfalls are, where the ambiguities are?

RSRM4: As you said, part of my job is to be the go-between between Legal Affairs and other faculty researchers. I got into this because I have run several ITAR projects and I guess somehow they thought that I would be useful in the capacity since I had some experience with it.

So the easy ones are when the sponsor classifies it as ITAR. The sponsor may come to us with a project that is maybe funded by the U.S. military or somehow or the other they have determined that there is some kind of an ITAR component to it, and at that point they say, "Okay, this project is ITAR." They're putting publication restrictions on it. The materiel, there might be a component that has to be locked away or covered or whatever. Those are the easy ones. They come to us, they tell us ITAR. We understand what parts are ITAR.

A project that I'm working on right now, there is a part or parts or assembly that is ITAR. We also built some components for that facility that we thought would not fall under the ITAR regulations, but the judgment was made by the sponsor, in conjunction with their military funding agent, that they wanted to classify even the stuff that we built to test that hardware as ITAR as well.

So it comes down to us that it's ITAR. We typically are very bidirectional. We communicate a lot. We try to make sure before we send anything out, is there anything else that needs to be classified. For example, in the particular case that I'm mentioning, the vessel had some mounting holes that they were concerned somehow might give away information about the device that we were using. So there is some judgment involved in it. There is a little bit of the attitude, 'When in doubt, classify it as ITAR, ' and that can be annoying at times. I'll be honest with you.

It costs money because the office that you're sitting in is an ITAR office. It is only accessible by certain people who I know have access to it. We have a number of those places here. Office space is at a premium. It costs money to set offices aside for things like this. It costs money to keep people away from things. It costs money in locking things away. Everything about it costs more money, even the facility that we're building. We had three or four people bidding for the construction. As soon as it became an ITAR vessel, we were down to one.

Krige: This building?

RS: No, this was just—

Krige: The device.

RSRM4: One device. So you go from a competitive bid situation to basically, "We are the only DOD-approved vendor." We have to go through them. So it ends up costing a lot of money.

You didn't maybe ask some of these things I'm telling you here, but if you're good with it, I'll just keep rolling.

Krige: Keep going.

RSRM4: We have to be obviously careful about who we hire for students. Generally that's not a problem. I mean, we have lots of very good American students. I recently, I guess last year, hired four new graduate students. All of them were Americans. Not one of them had a GPA less than 3.8. They've all been very good students. I haven't had a problem with I can't get good students just because I have to use Americans or U.S. persons. That, I think, is a commonly heard complaint that I think there are certain areas where that might be true, but I don't think that's a major hindrance. I think that's maybe something that it's easier or cheaper or have more access to. There are other things that play into that, but I think as far as if all you're interested in is getting high-quality students, we can get them. We can get them. That hasn't been a problem.

But that restriction is there. It does make it more inconvenient. We obviously work here in an environment—the lab itself is not ITAR. There's just certain areas of this building. So we have students that are not U.S. persons. We're very polite about it. Everybody goes to ITAR trainings and they all understand, even if they're not a U.S. person, they understand if I have a room and I tell you it's ITAR, nothing against you; we just can't let you in. So all that's good.

On the other side, the determination where the sponsor does not tell us that something is ITAR, our job, what I do is we go over and meet with the faculty member and talk to them about their research, what it involves. One of the first questions that I ask them is, "Typically, do you hire American students or do you typically hire foreign students? Is there a likelihood that in your lab foreign students would be there?"

If there's not, in a lot of cases you really don't have to go any further, and I have a couple folks that I dealt with that because of the nature of their research, they usually hire American students, and at that point, making an ITAR determination is kind of pointless because they're already basically handling it like an ITAR project.

There are other cases where people want to hire foreign students or maybe they have foreign students already working in the lab, and we need to make a determination. We have tools available to us. Once we learn about their research, we can go into basically the regulations and we can look through and we can find out if their research itself involves something that might need to be kept between U.S. persons only, or if it's something that is truly fundamental and really doesn't fall under any of those classifications. The regulations are really centered on fieldable and militarized equipment, so if I were developing something that would ultimately be patented and sold, the regulations are much more clear on those issue, or if I were developing something that could be directly integrated onto a military use of equipment, regulations are very clear.

On the other side of it, where we typically fall is either I'm building a scientific monstrosity that maybe has applications, hopefully has applications, but it's still an unfieldable thing. It wouldn't ride on my car; it wouldn't ride on the Space Shuttle, the now defunct Space Shuttle. It's not going to go directly on a tank. There's additional work that has to be done to take my monstrosity from where it is to a fieldable piece of equipment.

We were just discussing this the other day. Typically, U.S. government treats that gap between the scientific monstrosity that works and the fieldable device as sufficiently large that we don't have to make that ITAR.

Krige: That would count as a FRE, effectively, research but not developmental, I mean public domain knowledge, not restricted knowledge.

RSRM4: Right. Exactly. So in the academic world, there are very few things—we typically are not interested in development, so there are very few things—in fact, I generally go into things with the attitude that unless this directly runs afoul of the regulations, it's probably going to be fundamental research. It's a very rare thing where somebody's actually done the scientific research and now I'm trying to develop it for application.

Georgia Tech has a mechanism for helping them do that, anyway, that's outside of the university, so very little of what I run into in Aerospace is really that. I am involved in a project right now that does involve an element of scientific research and an element of fieldable military hardware. That's why it's ITAR.

Krige: You've implied throughout that if you have an ITAR restricted research project, you may not put a foreign student on it, but you can if you get a license for the student, correct?

RSRM4: I can if I get a license for the student.

Krige: And you don't like going down that road?

RSRM4: I've never even attempted it. Again, if we can get someone that we don't have to do that, then I think we would prefer to do that.

Krige: And what is your reason for that?

RSRM4: Well, it's a lot of trouble, in the first place, right? I mean, everyone has a threshold of pain. If I can get a student easily who can do this, why go through all this trouble?

Krige: It's a bureaucratic hassle, in effect.

RSRM4: Yeah, it's a hassle, obviously. And the other thing is, if I did exclusively ITAR work and I had a student that I—I have four students that work for me, and I put them on things that are fundamental, there's no ITAR or anything about it. I've got plenty of things to do that I can occupy them. So I tend to give them those types of projects, and if there's something over here that I need a U.S. person on, then that's who we go with. So is it pragmatic? Probably.

Krige: You've stressed that the kind of thing that falls under ITAR is a device, for example, and the sponsor says, "The position or the shape of those holes is something that we don't want anybody else to know." But, I mean, often you're upstream on that, and the sponsor might—you might be developing a new alloy, for example, which is actually a generic technology Inthis particular device it might be ITAR because the device itself is applicable to military use, but in that particular device, it might be very nice for some sort of—say a civilian jet airplane. How do you manage that boundary? And how do you stop students working on the one side of the divide, say, doing really important research on, say, the effect of temperature on this alloy, from speaking to students on the other side, who are actually developing this for a civil application?

RSRM4: Well, the management of it is through training. We tell the students you have to have an understanding when you go into the project, this is the thing, and you try to draw as clear a boundary around it for the student as you can. "This is what you can talk about. You don't need to show the piece of hardware. The data that comes from that device does not need to be shown."

Everything to do with that thing, we try to draw that—maybe gerrymander boundary around that thing, its data, and separate that from—if I had a student who's working on alloys, I just tell them, "Hey, I'm looking at using a highly corrosion-resistant, high-temperature alloy." That's a fundamental materials project. We want to avoid talk of applications. I would probably even be a little reluctant to talk about commercial applications because of the commercial part of export controls.

But at the same time, there's plenty you can do, just studying the fundamentals, that have nothing to do with the final applications. I could even tell you that I'm interested in looking at high-temperature alloy in the presence of things that are like combustion exhaust, for example, and I think managing that gap between what they need to know to do the project and what maybe telling them that information might lead them to believe or think, I think that's a management issue as well. Maybe I need to just avoid putting my Chinese foreign national on looking at new materials that might be used in jet aircraft wires.

Sometimes it's just a judgment issue, and I think we were discussing this as well the other day. It's a case-by-case, project-by-project, issue-by-issue, student-by-student, and it's very labor-intensive. As an engineer, I will tell you, as a scientific type, I would love—I have tried to come up with a checklist, "If this, then this," and it just is very difficult to do.

Krige: You've got a lot of foreign students in the building. I've noticed that from the images in the photograph in the lobbys. You have a great team. About three-quarters might even be, judging from the names, Chinese or Indian. These people then sort of live in a quasi—in a slightly separate world from your American students in terms of the research they do, where they don't have access to certain rooms, they don't have access to certain seminars. Certain visiting speakers might be giving a seminar which they're excluded from. And they accept all of that without any difficulty?

RSRM4: I think it's kind of the other way around. Most of what we do is not ITAR, so I think it's our ITAR people that live in a bubble. All of our speakers have clear presentations that are not ITAR. We're very clear, when people come to give seminars, that it's a public-domain seminar. There's no reason for them to come give an ITAR seminar anyway in a university environment.

I've never heard a complaint from our foreign students. People I hear the complaints from are the students working on ITAR projects.

Krige: And what's the complaint?

RSRM4: Their complaint is, "I don't see why this is ITAR. This is a real hassle. It's annoying. I have to lock these rooms." The restrictions.

Sometimes I think it's good to consider the alternative. I think the alternative, if there was no ITAR classification, would be that it's classified. And when you think about that, ITAR is actually pretty liberal.

Krige: That's for sure. I can see that.

RSRM4: So I think it's a "is the glass half-empty or the glass half-full" situation, and I think the complaints, most people are happy not to work on ITAR projects. I don't get complaints from foreign students, "I wanted to work on that," or anything like that. What I get is people that are involved in it are complaining about the restrictions and hassles. And to them I just have to tell them, "Well, hey, whether the law makes sense to you or not or the equipment makes sense to you or not, it's not our choice. We have to abide by what law there is." And considering the alternatives, maybe it's not too terribly bad.

I think also keep in mind the number of projects that wind up with serious ITAR—if it winds up with a technology control plan, it's ITAR or it's some kind of a controlled technology, [...]. The number of projects that we wind up having technology control plans on is pretty small. Even then, the technology control plans are pretty simple. We put ITAR projects in certain areas. Most people in those rooms are used to that kind of thing or at least tolerant of it. So we try to make it as painless as we can.

Again, I was meeting with a professor the other day, a new professor, who was concerned that what he was working on might run afoul of the issues, and after thirty or forty-five minutes, we basically came down to, "Here are some ways that we can avoid running across any issues with either the commercial sector or the military. You can do your research, and I think the only issue might arise when it comes time to publish your research." It was a satellite-related thing. "If you happen to have taken a photograph of a U.S. Air Force satellite, then you may have problems getting it published, so don't do that."

Krige: Right. There are things that you can avoid.

RSRM4: There are lots of things you can avoid. That's right.

Krige: I've spoken to project managers at Jet Propulsion Lab, and they say that sometimes in seminars they actually have to stand up and say, "You may not ask that question. You're pushing the limits. This is an ITAR-free seminar." Yet ithe answer to that question would immediately push you over the threshold -- do you find that happens frequently?

RSRM4: I've never seen it happen.

Krige: Do you find students self-censoring? I spoke to one student who was an Iranian, and he's extremely worried. He's doing totally unclassified work, but, like everything, it's a platform with certain kinds of applications that can sound as though it's military, and he's very afraid of being accused, perhaps, explicitly or not, perhaps of being interested in the military application when he's not. So there might be problems of self-censorship that goes on amongst the students when they sense that the thing might be interpreted as a military-related question when they're really not doing military-related work.

RSRM4: Right.

Krige: Compared to, say, being a graduate student twenty years ago, this must make the whole process of learning rather less fluid, free-going, open-minded, open-query than it would have been, right?

RSRM4: Right.

Krige: Does that bother you particularly, or do you think it's just the way we have to be?

RSRM4: I'm thinking about his particular situation. I was actually thinking about something related to this earlier, and it has to do with our attitude toward people versus governments. We as a country, I think, separate, for example, Iranian people from their government. So when I meet an Iranian, my natural assumption is not to assume that he's hard-line whatever.

Krige: Anti-American, for example.

RSRM4: Right. That's not my assumption. My assumption is that most people there and most people in general, is that their intents are wholesome and they're not intent on getting in trouble. It would be a pretty poor choice to come here and be working in an area and be so forthright about things if you were trying to spy. I think you'd want to be a little more quiet about it.

I think what you're relaying is totally his perception. I've never gone around to a foreign student who was asking questions and chastise them for that. I might say, "Well, I'd rather just avoid talking about it in general," if it got a little bit—I was more worried about myself than them. I was not worried about their question. I was worried more that me being familiar with it, I might inadvertently say something in the classroom, for example.

I just finished teaching a class on the science and design of gas turbine combustors that are used for military and commercial engines, and there are times when something might pop into your head from research, "Well, we'd better just move on." You might want to bring it up and you just kind of self-censor.

So here's the issue. Does it hinder the learning process in the class? The reality, I think, is the students are at a completely different point than I am with this. They need to capture the fundamentals. They don't need necessarily the cutting-edge research when they can't even figure out which is the front and the back end of the combustor. So we're at a point where we're teaching people why does the engine look like it does, here are the major components, here are things we've learned about their performance over the years, and everything we teach—I don't have the book here, but it's all in the book, and the book can be bought anywhere in the world. So as long as I stick to the text, I'm pretty good. And there's plenty that they won't learn that's in the text. There's still plenty of anecdotal things from research you can throw in to make it interesting.

So I think, again, if I had a situation where someone had gone completely through and knew everything in the text, and then needed to know something we were doing in research, maybe that would be hindering their learning. I don't think we're at that point. I think they're at a sufficiently steep point in the learning curve where what we're dabbling around within the lab is probably not enhancing their fundamental learning.

What we're trying to do in class is enable them to go to the lab and learn. I guess I might also cynically say that I'd be a little cautious telling them what we're learning in the lab, because it might not be right. [laughter] So maybe we're better off staying away from some of it.

I'm sensitive to the case you're talking about, though, because I think the student in this case is probably overly sensitive. He's hyper-sensitized.

Krige: They are, of course. Even with those who are not, let me shift the debate a little bit. You use, I see, a lot of diagnostic tools. That's one of the things you're strong at. These diagnostic tools obviously shunt across the boundary between military and civilian applications in certain areas. That must be the case. So you're training Indian students to handle diagnostic tools and to improve their performance, perhaps to do very advanced kind of diagnostic work, which might be of use to a foreign nation. And he needs to do that for his Ph.D. First of all, can the use of that diagnostic tool be ITAR-controlled?

RSRM4: It might be.

Krige: It could be. So how do you stop him crossing that boundary?

RSRM4: There again, we have to go back to regulations and say is this device somehow regulated, either/or ITAR and is it somehow regulated.

Krige: I've done an ITAR training. I didn't study exactly what falls under combustion and diagnostic tools, but do some diagnostic tools do fall under ITAR specifically, and you have some of them in this building?.

RSRM4: None that I know of.

Krige: That's good.

RS: And even the commercial things, for example, some of our velocity-measuring pieces of equipment, they come from Europe anyway, so there are licenses both ways for export and shipping around, so everything, to my knowledge, diagnostic-wise that I have, that we have in this building, anybody can work on. The gap between using a piece of equipment and developing a militarized application with it or doing something with it that might be used to develop is a sufficiently large gap, and we see no problem with that.

The only diagnostics that I'm aware of in this building that have any ITAR restrictions are on that project I'm talking about, and it's this piece of equipment and this one and this one, and I know what they are and they're not ready for primetime anyway. When we get things, the technology readiness level is pretty low. I think out of nine, we might be three or four. So I think even if I were to put someone in there with this thing and train them to use it, I think the gap is still high, but the military has classified this technology as ITAR, and so we just [unclear] the issue. But everything else, our major diagnostics, they're not.

Krige: I spoke to somebody who works in the nanotech lab on the other side of the campus, and he's a foreign national. He told me that the device that he uses—I think he might be manufacturing chips of a particular kind, and this is a very difficult piece of equipment to use. As you learn to use it, you get better at it. You can make better and better chips, and these chips can, of course, have military applications. So you don't have anything similar to that, which might, in the course of his own research, change from non-ITAR-controlled to ITAR-controlled? Apparently you don't have that.

RSRM4: No, we don't have that, and I think even in that particular case, the way we would handle that is if the instrument itself is not regulated, fine, use it. We will monitor your research periodically, and if it looks like what you're doing is beginning to boost the boundaries, then we'll say, "You've either got to change course here or we're going to have to [unclear] project." But I think, again, we're there to try to provide guidance.

I hate to use the term "avoid," because it sounds like you're trying to get around regulations that are put in place theoretically to protect us. That's not what I'm trying to get across. It's not that. What we're trying to do personally—this is an attitude. My personal intention is to enable you to do your research, whoever you are, and yet at the same time let's keep you away from any boundaries that might get you into trouble, and unless it's absolutely critical to your research—there are many forks in the research path. Just because we have this branch available to us doesn't mean we have to take that branch.

We can take these five other branches and you can get your Ph.D. And that's one component to your Ph.D. Writing your thesis is one piece of the process of learning things. If they insist on doing that one part, now, we can go and request either a license to do it or we can ask for a judgment whether our nervousness about where it's going is really warranted. There's lots of things that we can do in a case like that.

We try to go after the Fundamental Research Exception if we can. That's a general policy. I was talking with someone who was from a government lab and has worked in industry with things like this, classified and unclassified ITAR, and his opinion was that we were probably a little bit broad.

Krige: Too all-inclusive.

RSRM4: Yes, we were probably including more than was necessary.

Krige: More conservative than you need be.

RSRM4: That's a little bit of a fear factor.

Krige: You see the penalties.

RSRM4: That's right. And a lot of it has to do—we try to act in good faith. If there's a point where we just don't know, we'll tell somebody, "Listen. This avenue you're going, I don't know. Here are things we can do to find out. We may have to request additional help in finding this out." And usually what you'll find out is as soon as you start, they'll say, "Well, I don't have to do that anyway. I can accomplish the same thing if I do this. I can accomplish the same thing, instead of taking a picture of that U.S. Air Force satellite, I can take a picture of a rock or I can take a picture of an old defunct Russian satellite." Okay. So we've—

Krige: Solve the problem.

RSRM4: —solved the problem amicably, and they're safe and we get to move forward. A lot of things turn out like that.

Krige: I was told that on some campuses that face this problem, you actually put a bit of extra money aside so that if a student, say, in his or her third year comes up to one of these forks, "For you to take the good fork, actually you're going to have to step back a bit. You're going to take an extra year to kind of get up to speed to get on the good fork. We've got a bit of extra grant money for you here that we've set aside for just this kind of situation so that you don't have to take the fork which leads you under the regulations." Do you do that kind of thing or is it something that we don't do here?

RSRM4: That would require some forethought and planning. [laughs] Usually our contracts are sufficiently tight. At the point where a student gets to the point of proposing for his Ph.D., we can usually carve out something. First of all, for a Ph.D., you don't want a development project. So we want to carve out a science project for them. At that point, funding does get hard because the project says we're going to do x, y, and z. Usually some component of doing x, y, and z has raised this, "Wow, this is an interesting thing we should go investigate." That interesting thing we should investigate is usually what the student is going to do his Ph.D. on. It's rarely the line item of the project.

Krige: What you need to know, shall we say, in terms of fundamental research in order to get to where you want to go in terms of the project. Sort of a gap in knowledge.

RSRM4 Yes. We're involved right now in an Air Force project that's completely public-domain stuff, and the project itself has enough pieces and parts that are unknown information, but even with that said, if I take a certain set of data for this project, at some point the student is going to want to do a deep dive, for lack of a better term, into the set of data. Maybe we're just going to turn the data over. Maybe the data stuff will just be published. But at some point, the student needs to do a deep dive into a thing and generate something of his own. It's probably not in the critical path of accomplishing the grant itself.

Now, like the Air Force project I'm referring to is a very basic science, it has a roadmap. We want to accomplish the goals of the project, but at the same time it is fundamental research. We do get paid to look into those nitty-gritty issues that come up along the way. But again, the other type of project that we do tends to be industrial in nature, and other military-funded projects that we are subcontractors to a company, in those projects the deliverables are very clear, the company expects to get something very close to those deliverables, not in results, but we are going to make these measurements for them. Maybe there's some interpretation involved or whatever, but we're going to make these measurements. So we have to keep on track with the company to keep getting paid.

We then typically will take the student aside at a point where maybe there's a year left that they proposed for their Ph.D. and we say, "Okay, we've done this. We'd like to learn more about the fundamentals of low-temperature behavior" or something. So we pull them aside and they're getting paid, of course, but they're in a bit of a holding pattern and they're focusing on their little thing, and we do largely have to cover the costs of someone who's almost unproductive on the main line.

Krige: Right. I get it.

RSRM4: It's kind of what you're saying. I just don't know that I've ever thought about it as we'd better set aside another $100,000 to pay this guy for a year to do it.

Sometimes we will pay them as graders, graduate teaching associates, to get them paid while they work on that. There are some games we can play.

Krige: With industry, you have a lot of Nondisclosure Agreements, I guess. Do these exclude foreign nationals automatically, or not necessarily?

RSRM4: Not necessarily.

Krige: And the Nondisclosure Agreement is explained to the student and you trust the student not to disclose.

RS: We expect them to be professionals.

Krige: Industry's funding more and more of this kind of research. If you look at the data, compare the federal government funding to industry over the last fifteen years, industry's goes upwards sharply, while the. federal government's kind of leveled off. So are you finding more and more NDAs, that kind of project, coming your way?

RSRM4: We have NDAs with lots of companies. I mean, it's just normal operating procedure.

Krige: It's not more onerous than ITAR or less onerous?

RS: Oh, no, no. It's, I would say, largely less onerous. We have a Legal Department that handles NDAs. Usually speaking, if I'm working with a company, I tell them upfront, "There are certain types of contracts that we have here. We have NDAs. This is what happens with intellectual property. You need to know that today. You don't need to find that out nine months from now when I've got this new thing and you're mad at me because Georgia Tech's claiming intellectual property."

So usually what I'll do is I'll talk with Legal Department and get boilerplate contracts and boilerplate NDAs, send them over, put them in contact—I don't want to be part of it. "Let me know when you guys thrash it out and I'll sign when it makes sense."

Krige: And they vet the students? The companies can not vet, but the companies just say you put students on there that you want, or do you say, "I'm putting two Indians, one Brit, and a Frenchman on it"? They could say, "We don't want any French on that." Could they do that? Do they—"intervene" is the wrong word. Do they try to steer the negotiation in such a way that certain people aren't there?

RSRM4: Never had it happen.

Krige: So they trust your judgment on that one.

RSRM4: Yes, they do. The NDA is a legal binding document. We have colorful language for it, but bottom line is that we work for money, and if I do something that an aerospace contractor does not like, when it comes time to renew our contract, they're not going to renew our contract. That can have implications not just for me. This contractor may have other projects even in our own group. We're very careful about honoring these things and being careful with their information.

I remember when we first started working with a particular company, they were providing us manufacturer drawings for their engines, and they just requested, "Keep them locked in a file in your office." They do trust us. I think it comes down to, "We trust you until you screw us, and at that point, no more contracts."

Krige: This has been made clear to me. It's not so much the fines. [...] The fact that that's the end of the funding stream, can really be extremely damaging.

I sat in a room with an ITAR training session, a day and a half, and everybody was an aerospace contractor, small aerospace, some of them just 4 or 5, making something very tiny, say, special lenses for goggles or something. They were terrified of breaking the regulations because that will be the end of their business. Not the fine of 10 million bucks, but they'll never get another government contract, and without that, they're dead in the water. So I understand that side of it.

RSRM4: I think if you look at us as independent contractors, it's a good way to look at it. It is what we are in a lot of ways. We have our own little—it is a research business, but we have our own little world, and we definitely want friends. First of all, we want to do a good job. Ever since day one, I've always had the attitude I want my customers to be pleased, I want to do a good job for them, I want to learn things as well, but the learning stops the day I can't pay. So I think that's the number-one issue.

I even had in one particular case, the company wanted for commercial reasons us not to publish. Georgia Tech does not write those contracts. We will write government publication restrictions, whatever, and occasionally with companies that—in this particular case, that was just a nonstarter. And I told them, I said, "Guys, I can come to you with a gentleman's agreement that I will publish nothing without at the very least you approving it. The important thing here is that I want your business."

And they, kind of surprisingly, accepted that, and we have worked under that arrangement now for five years.

Krige: But sometimes they might ask you, for example, in drawing a graph in your public-domain paper, not putting in the y and the x coordinates, the data. So you just get a curve without knowing what's the top and what's the bottom. You accept that as, "If you let us put it in the public domain under those conditions, we're green for go." You accept that kind of constraint?

RSRM4: Yes. A more direct example might be, "We want you to black out this part of an image. We want you to hide our injector." I've even had the military do this, "We want you to hide the profile of the combustor." The picture is okay. When it comes to data, if the data itself revealed something about the engine—for example, they had developed a new alloy that the turbines would all of a sudden take 1800k, and we were testing and we were showing those data, that would be taboo for sure. Usually we can either nondimensionalize data. We can play all kinds of games that show the right trends, show the learning aspect of it without revealing details about the engine. So it's a give-and-take.

Krige: Your journals accept that that's an acceptable paper to have and to publish?.

RSRM4: Yes, that's right. And they can reject it if they want. I think also we've done this as well, where there were contracts that had no-publication agreements in them, no-publication agreement does not mean you can't publish. What it means is that you can't just go out there and free-wheeling publish. We can still send a paper through the channels, for example, with the military, and get them to clear—

Krige: Only publish after review.

RSRM4: Right.

Krige: Sixty day for their review?

RSRM4: Whatever their requirements are. We've done that before. We've had projects that were no-publication, and they approved a paper.

Krige: What about deemed exports? Is this a problem for you? You must have a lot of visitors through here, including people like me, who are not American citizens. Well, I'm a permanent resident. But shall we say from China. Does that somehow impede your conversation? Do you take a lot of measures to deal with problems of deemed export? Do you get licenses for every foreign visitor who comes here?

RSRM4: First of all, anyone who comes from a denied entity isn't coming here.

Krige: That's done upstream.

RSRM4: It's done upstream, and there are lots of unpleasant conversations that sometimes go on about it, not between us and the visitor, but family fight.

Krige: Up the line, yes.

RSRM4: Family fight here. But bottom line is, if they're a denied party, they're not coming in a building like this. In fact, they're probably just going to get a walk-around Georgia Tech's perimeter and past some buildings. They will go through buildings and shut doors and tell you, "This is where we do underwater basket weaving, and you're not going in there." They don't say that, of course.

The other thing, if we have visitors, let's say Asian or something like that, obviously we have to look at the country itself. Then we have to look at the individual, him or herself. It's actually a pretty quick thing.

Krige: Through the visual compliance system.

RSRM4: Exactly.

Krige: I can log onto that. I know how that works.

RSRM4: We run their name through there, and if we get anything, then, fine. With that said, obviously we can't take them through anything that is export controlled or ITAR, but there's lots of things you can show them.

Krige: Again, you can't take them through without getting a special license to do that. How long does that take? Have you ever tried to do it?

RSRM4: I haven't.

Krige: You wouldn't bother. It's too much hassle.

RSRM4: For one thing, we don't have time.

Krige: But a visiting professor for three months might be a trickier one, say, from France, who works at Toulouse and is close to Dassault.

RSRM4: We do that all the time. We can do that kind of thing without any problem. We would not expose them to anything from GE or Pratt & Whitney or Rolls-Royce.

Krige: For competitive reasons.

RSRM4: For competitive reasons.

Krige: But that's covered by NDAs already, right

RS: Right. That's covered by NDAs. And most of the other things we do, there's a sufficiently large gap between what we're doing in either commercialization or militarization, that it's FRE. The things that aren't, they have red noses on them. I mean, we know where they are. I can walk you around right now and say, "You can't look at this." So it's usually sufficiently bounded that we know it is not a problem.

Krige: Just to get back to that FRE, how many times do you say, "Damn, I don't know whether this is on the right side or not. I'd better consult with the State Department," or another colleague at Caltech. Does that happen one in fives times or one in ten times?

RSRM4: Well, the first part of that happens every time. It's very difficult in a lot of cases. I've used this example a lot of times. If a person writes a program—we should be careful about this. It isn't just pieces of equipment. I use that as an example, but—

Krige: It's all forms of knowledge, blueprints, software.

RSRM4: But they have to be at a certain point to be really considered. So I've used this example before. If I write a piece of software in Matlab that can be used to control my—I have a little satellite simulator that floats around the floor on air, and I can guide it around the room. I write a program in Matlab that will identify an object in the middle of the room and will steer the satellite around it, and I do all of this in Mat lab with my toy satellite and all this kind of stuff, that is nowhere close to being something that I can go to a company or the military or anybody else and say, "Here." [It is not something they can just put on something and use it, so there's a big gap. There's a gap between this monstrosity that I've created and demonstrated, and actually something that's fieldable. It's the width of that gap that we're constantly pushing.

Krige: And that isn't always easy to do.

RSRM4: Somehow or other, it's never easy to do.

Krige: I imagine so. I used to be a research scientist myself, so I understand. I understand it's not easy to do.

RSRM4: You're relying on the people that you're talking to. I assume when I'm talking to you—in fact, I go a long way to try to help them understand I'm on your side. We're not out to make this something that it's not. I want them to be really comfortable, because I want them to really tell me the truth, because I really want to help them, but I really don't want them to wind up in jail, and I don't want me to wind up in jail either.

I think, again, if you look at some of the cases that have wound up in jail, they are so flagrant. I'm thinking of one in particular that's kind of our case study. I'm sure you know who I'm talking about. It was not a situation where he inadvertently did something, he thought it was FRE and it turns out, lo and behold, it's not FRE, and they lock him in jail. It is something that was known to be sensitive and he flagrantly violated multiple restrictions, and upon being warned multiple times, continued to flagrantly violate the law. At some point, you just have to say—

Krige: He's testing the limits, and at some point you can only go so far.

RSRM4: That's right. Something about Georgia Tech, I don't know of anyone here—of course, I have to say this for the record, but I don't know anyone here who is flagrantly trying to test the limits. If we tell them that, they may argue about it. If we judge it to be FRE and we find out later on, oh, goodness, it's not, we fix it immediately. We get it right and move on.

Krige: And you report that back to the State Department. Of course, they, too, probably are sitting up there in Washington, their engineers are probably not sure. I've spoken to an engineer in a small firm, Aerojet, who is going crazy with ITAR, because he said, "I develop, say, a new nano product. I phone the State Department. They say, 'We don't really know.'" He said, "I mean, guys, if you don't know, how do I know? And what happens if some guy goes and takes my product and puts it on a missile out in Pakistan, and then you come and hammer me for exporting it to them? I need more clarity from you." And he basically ended this conversation by saying, "For us small businesses, this is a complete nightmare because we are stepping back from doing this kind of innovative work because the risk are too high for us. The risks of something going askew are too high for us. We can't do it. We have to leave it to the big companies."

RSRM4: This is the nature of the regulations.

Krige: This is the story that you've heard?

RSRM4: We have the same conversation ourselves. If we were to go to them, they would turn around and ask us, and we would wind up making a self-determination anyway. But, you know, if I could don a political hat here, I mean, is this not the nature of massive government regulation? It's just that we're running afoul of it in a different way. I've heard multiple company stories where basically they said, "Hey, if I had to start my business today, it would never happen." There would never be another—I can't remember what the company was now. I don't think it was Apple, but it was somebody like Apple. It's impossible to start a company like this today. The regulations are just massive.

Krige: And that's the state of the world. It's the government, but it's also the state of the world, right? As long as America was really the leading technological power on the globe, okay, we were in competition with the Soviets. We knew the Soviets were way behind anyway. So as soon as we opened the markets in the seventies, the eighties, we knew they were way behind.

Now it's another ball game. I mean, really there are a lot of very, very competitive industrial firms. So in terms of economic security and national security, it's another ball game. So I can understand why these regulations are there, and, of course, 9/11 escalated the stakes. And politically it's impossible to pull back on regulations. That's a very tricky thing to do. Whether you're a Republican or Democrat doesn't matter, because, my god, if you make a mistake, you're going to get hammered politically for it. So the whole context is one in which, I mean, everybody's between a rock and a hard place.

RSRM4: It's irreversible.

Krige: May I ask how long you've been in this business? Ten, fifteen years?

RSRM4: Since '98.

Krige: Have you seen an escalation in these procedures since you've been in this?

RS: Oh, definitely. When I first started working here, I never even heard of it. I can't say for certain whether the reason I think that it's escalated is because I was in a bubble or because it really escalated. When I first came here, we were a relatively small lab and mostly government contracts. We had really two professors—I was a graduate student at the time—two professors who did all the research. We had another brand-new professor at the time who had just come along, was doing some research, and in many ways the work that we do, we do as teams. So you might have a large university research initiative that all the professors have a component in, even multidisciplinary stuff. I was working on a DARPA projectSo at the time, I think it was the nature of the projects.

Around probably 2000, we moved to this building in the year 2000, and at the time we were worried about filling this building up. We literally were laying junk around the building and not cleaning up, because we were afraid they would come take our building. But then within short order, companies began to realize, "Hey, these guys have some real capabilities. They have people that can make things happen, and they can do things cheaply and quickly." I call it fleetness of foot. We can do things on a time scale that in many cases they can't do.

One company that we work with, they can turn out a new mixer, a fuel air mixer, send it to us, we can run it, give them images of the flame and emission results and everything else before they can put it in a rig at their place. It's actually a nice process. They get these data and then they can think about them, they do their rig test, and it helps them interpret the results.

But that fleetness of foot, a lot of things about our lab have caused more and more industry contact. With the industry, that means in the aerospace world one of those guys is going to have a military contract, and so it's almost just luck of the draw. You're going to get one every now and then. We have a couple.

I think also some cases, probably the government, of course, got more sensitive after 2001, started looking at all the things that were going on in universities. So it probably is a little bit of us coming out of our bubble, 2001, 9/11 attacks, government raising its head, "Hey, we've got to see what's going on out there," and all of it kind of just aligned. So I'm sure—in fact, I know there are professors here who still refuse to touch anything ITAR.

Krige: Because it completely destroys research as they know it.

RSRM4: Yes. I mean, I work personally with one of these guys, and I tell them, I say, "Look, if you have a philosophical issue with it, that's one thing. If it's a practical thing, I think we can work around it." I think there's a wall that they don't quite know how high it is. They just see a wall and they never look up. I try to help them get over that, particularly because I think he's limiting some of his opportunities.

You asked something a while ago. I meant to mention this earlier. You were talking about students feeling left out because of ITAR work going on.

Krige: These two worlds, these two domains, two sort of regions of the building and areas of investigation.

RSRM4: Or a concern by the student that maybe he would raise the attention of people he didn't want raised. I have on occasion had students—and I am very upfront when I talk to a student about projects. I said, "Listen. This project involves the military. It involves this or that or the other. If you have ethical issues, military ethnical issues with rockets or whatever, whatever your issues are, it's not my business to know what your ethical problems are, but I want you to understand that's what this project is about. If you have ethnical issues, you owe it to yourself to be upfront about it and we'll find something else for you to do." And I've made it very clear this is not a firing offense. This is just a personal issue. I'll put you on something—

Krige: Where you don't have to make those compromises.

RSRM4: And I had a student who he was not my student, he was someone else's student, he was involved in a project. He was actually a U.S. citizen. He was very concerned about a project. I personally don't think there was anything wrong, but he was concerned about it, and he ultimately, on his own volition, walked away and just said—he was constantly worried about it.

Krige: Our time is up. Thank you.