Conversation with Stefan Kudelski

John Rice, Videography, September 1985

The man whose Nagra has scaled the heights of audio recording hopes to echo its success in new areas

In the realm of location audio recording, there is probably no name that is more respected than Nagra. For nearly 35 years, this small company in Switzerland has produced a series of audiotape recorders that are renowned for their sturdiness, reliability and longevity. Not only do they record some of the best sound in the field, they've also been dropped, kicked, thrown, bounced, soaked, steamed and frozen—and they still work.

Nagra tape recorders are the creation of Stefan Kudelski, who moved to Switzerland from Poland at the beginning of World War II. In 1951, he formed Nagra/Kudelski and sold his first tape recorders (the Nagra I) to Radio Lausanne and Radio Geneva. His list of customers now reads like an international who's who. The number of Nagra machines sold is equally impressive. The Nagra I was followed by the II and, in 1958, the III, which became the de facto standard for audio location recording. There are reports of Nagra IIIs, which are no longer in production, being sold second-hand for greater than their original price.

The III was followed by the IV and the 4.2, the two current offerings from Nagra. They come in mono and stereo configurations and the latest addition is center-track time code. Nagra/Kudelski also produces the SN series of miniaturized, high-quality tape recorders that fit into a jacket pocket.

Nagra/Kudelski is more than a tape recorder manufacturer for professional audio applications in radio, television and film. The company also produces instrumentation recorders for logging and scientific use, including the T-I, TRVR and IV-SJ. The T-Audio machine for music recording, broadcast and cinema is an outgrowth of the T instrumentation machine. Most recently, the company has moved into the videotape field with theVPR-5, a 1-inch portable videotape recorder with the usual Kudelski standards for high quality and sturdiness. Representing a departure for the Swiss company, the VPR-5 is a joint venture of Nagra/Kudelski and Ampex, which markets the machine.

In the course of producing an on-going line of respected machines, Stefan Kudelski has been well recognized for his achievements. He has received two Technical Oscar awards (for the Nagra II and the Nagra 4.2), as well as a major Oscar award in 1979 for the entire Nagra line. Kudelski and Ampex were awarded an Emmy award last year for the VPR-5. Two awards from SMPTE and one from AES have been garnered by the inventor, and the list goes on.

While gaining international acclaim along with a long list of customers, Stefan Kudelski seems quite comfortable in his adopted country of Switzerland. His manufacturing operation has spread to five locations around the country. The main office building houses a research facility, which is developing the next round of Nagra products. It was at the home office in Cheseaux, Switzerland that Videography's editor, John Rice, caught up with the inventor after visiting the Montreux television symposium down the road.

Videography: I've heard many stories about how you came from Poland to Switzerland.

Kudelski: I was born in Poland in '29. I was a little boy in Poland and we were stuck there. My family left Poland, went through France and came to Switzerland.
I went to school in Lausanne and when I was in school I tried robotics because my passion was electronics. At the time, there were few people interested in that. The idea was to use magnetic tape for the memory in robotics. You first have to get familiar with magnetic tape. I made some recorders [for memory]. Then I tried to go into robotics, but nobody was interested in it at that time.

Videography: How old were you when you were doing that?

Kudelski: It was 1950; I was 21. I found that nobody was interested in robotics, but people were very excited about the recorder that I created. So, I became a manufacturer of recorders. That's how it started.

Videography: Was that the first Nagra?

Kudelski: Yes, the Nagra I. It was just a gadget. When I saw that this was a serious market, then we made the Nagra II with improvements over the Nagra I. Then the Nagra III, which was very serious equipment. I built that in 1956, which means I was 27.

Videography: The Nagra III is legendary.

Kudelski: It was a good machine.

Videography: How many IIIs were sold?

Kudelski: Oh, I don't know. In my office I have the number 30,000. All together the III and IV sold maybe 100,000.

Videography: The III was a sturdy and precise machine…

Kudelski: That was for a simple reason. We had a very, very small company, so we were unable to offer good service and maintenance. So we had to make the machine very reliable. It was a must.
If you manufacture typewriters or TVs, it is easy to have maintenance service in every town, where they own the televisions. But not in the middle of Africa, so you have to make the [recorder] reliable. It was cheaper for me to make them more reliable than to spend money on maintenance.

Videography: What about the miniature Nagra recorder, the SN?

Kudelski: It was done in 1960. But at that time, you see, in Switzerland, we had a very bad problem. Industry was going too strong. Our government made some rules [prohibiting] companies from increasing the number of employees. For years and years, we had to stay with the same number and this completely [prevented] our expansion. When the limitation finished [about 10 years later], the market was already technically advanced. That was very bad for new companies—you see, old companies were established.

Videography: Did you have plans for things you wanted to do during this time, but couldn't because of the hiring restrictions?

Kudelski: At that time, it would have been possible to become a much larger company. But only since 1970 have we been able to start to expand again.

Videography: Before we move on, what does "Nagra" stand for?

Kudelski: Oh, it's very simple. It is Polish etymology. Because I had to quickly come up with a name for the product, I was not in a position to investigate using a name that might be already in use. I didn't want a name with "phone" or "cord" because there was a 90 percent chance that somebody was already using [a similar name].
My friend Mr. Studer made the Dynavox and had to change it to Revox. So I took a name exotic enough that I didn't have to take that risk.

Videography: What does it mean?

Kudelski: Something that records.

Videography: The monophonic Nagras use a synchronization system called Pilottone, recording a sine wave on the upper and lower edge of the tape, out of phase. How was that system developed?

Kudelski: I didn't invent it. Pilottone was invented by a German man, I don't remember his name. He was

from Bavaria. But originally, Pilottone was recorded without bias and there was a lot of modulation noise. We tried to make a recorder that was compatible with Pilottone that would create a similar signal but without the modulation noise. It just worked out. Very simple.

Videography: About the same time that you introduced the Nagra with Pilottone, Jack Mullin was working with a German Magnetophon, captured at the end of World War II, and Richard Ranger was developing Rangertone, a similar system to Pilottone. Did you work with these men at all?

Kudelski: No, they were working at the same time, but without my knowledge.

Videography: There was no communication among you?

Kudelski: No.

Videography: So it was accidental that you and Ranger came up with somewhat similar systems at about the same time?

Kudelski: The need was there. Some people say that one of us copied somebody else. The basic idea is the same.

Videography: Why do you think the Nagra recorders have become so widely accepted in the American film industry, and internationally?

Kudelski: There are several reasons. First, I would say, because I had a partner, Loren Ryder, who was excellent. He may be the main reason. He just passed away. He was 85. He was so nice and so competent that he may be the reason for the success. But there are other reasons that may be more philosophical.
In general, large companies are not interested in a product such as recorders where the market is too small. And the people who are interested in this kind of product may not have the technology necessary [to manufacture and create them]. I was just beginning my career, so I had no choice. I like sound, I like music. If you do something seriously, you've got a chance.
You must also be a little lucky and you must be doing it at the right time. And there is another reason. Here in Switzerland, we had a man, Werner, involved in broadcasting. He was extremely *exigeant*—that means he asked for the best in every respect, like the BBC does today. It was exciting for me to meet his requirements. And if you [gave him] what he asked for, it was very easy to be ahead of everyone else. Now, we are trying again to use this method of having pilot customers. There are some customers in the world who will ask for today, what everybody will be asking for tomorrow.

Videography: The stereo Nagras—the *4.2-S,* IV-S—when were they first introduced?

Kudelski: Oh, I don't remember. You see, I am only interested in the future, not so much in the past.

Videography: Did you do research and go through investigations to decide to make a stereo Nagra?

Kudelski: No. I have a friend. Marcel Cellier, who liked to record discs of ethnographic music and he needed to do this in stereo, so he badgered me enough to have this model made for him. That's all.

Videography: The synchronizing system on the stereo Nagra is different from Pilottone?

Kudelski: Yes, because Pilottone is based on the symmetry of the recording, and that works only with mono.

Videography: Did you develop the system for stereo or was it existing technology?

Kudelski: I developed it. It was a very simple system. It was FM recording, like the standards in instrumentation—very conventional. If you have to record a channel with low frequency, use FM.

Videography: Is that system a direct relative of center-channel time code?

Kudelski: Yes, you use the same heads. Again, if you have to add some things, you add them between channels. There is nothing very special about the system.

Videography: There is a good deal of talk that your center-channel time code machines will sweep through the television business.

Kudelski: Yes, it's going very well. People must learn how to use it and the best way to use it. People are going to double-system recording now for higher quality sound. The problem is that in video, the tape is optimized for picture, not for sound. And the tape is expensive, so they left very little room for sound.

Videography: The Nagra III is known for film sound production, isn't it?

Kudelski: It was first for radio broadcasting.

Videography: But it seemed to make its mark in film.

Kudelski: Yes, especially in the States. Here in Europe, it was first used in radio and in musical recording.

Videography: The T-Audio is different from the I, II, III, IV and 4.2 series. What's special about it?

Kudelski: The T is the instrumentation recorder with two-capstan construction. Don't forget this. Two-capstan is necessary for FM. After [we made the instrumentation recorder], it was simpler for us to use the two-capstan system [for the TC] than to redesign a single-capstan recorder. It would cost more for us to design a simplified version, so for that reason, we continued to use two capstans.
There are some advantages to having two capstans. If you have problem splices on tape, you are completely insulated. In the laboratory, you get .01 percent of wow-and-flutter. We don't point this out in production because it's not necessary, but you have it. That means a very, very low modulation. So many people use it for mastering in competition with digital recording.

Videography: Meanwhile, all of the time code machines are getting more and more of a hold on television production.

Kudelski: That is in the States. Our partner, Loren Ryder, was *a* man of pictures. In the States we are strong in television—but only in the States. In other countries we sell a lot to [radio] broadcasters.

Videography: Are you consciously going after the television and video production market?

Kudelski: It is exactly the other way. It is like an actor, when he starts making one kind of film, they go to him for only that. He'd like to play something else but he's classified.

Videography: Typecast.

Kudelski: Yes. So in some countries, we are mainly suppliers of instrumentation equipment, in some others, radio, in others, music, in some others television.

Videography: Do you expect the Nagra to become standard in television production?

Kudelski: If this happens, I will be very happy. But it is not up to me to decide.

Videography: Let's talk about the VPR-5 portable 1-inch videotape recorder, which you make and distribute with Ampex. Did you decide, I want to make a video recorder?

Kudelski: It's much more complicated than that. You know, we were looking at video from the beginning. At the time of quadruplex, a portable [machine] was possible, because Ampex did it, but it was difficult. As

long as quadruplex was the main recording format, we had nothing to do with the field.
When the 1-inch format came along, we tried to work with it. But it wasn't wise for me to try to make such a recorder alone and re-invent the wheel. We had better things to do than re-invent the wheel. So we started discussing things with the best people in the field, and that's all.

Videography: Did Nagra and Ampex work together on developing the VPR-5?

Kudelski: Yes. That means that they supplied us with information and small tricks, and this allowed us to make the recorder very quickly.

Videography: Ampex is exclusively selling the VPR-5 now, except in Switzerland and France, where Nagra markets it.

Kudelski: Exactly. We are very happy with this. There is a problem because a self-contained recorder represents only a small percentage of the market in the professional format, the C-format. That means that the density of recorders throughout the world is quite small. It is not worthwhile for me to have a laboratory for maintenance in every country. Ampex has one already. And, most of the time, our tapes are played back on Ampex equipment, so it's much simpler to work together.

Videography: But you are now making the VPR-5 completely within the Nagra/Kudelski operation. Is Ampex manufacturing parts?

Kudelski: No, we make them here.

Videography: Are there plans for other Kudelski video products?

Kudelski: Maybe, maybe, I cannot say.

Videography: You're not going to give away any trade secrets?

Kudelski: We are working on cameras, too.

Videography: Is there a timetable for production?

Kudelski: Yes, we have them. We love our competitors, but we don't see any reason to inform them of our plans.

Videography: One area that I am not fully familiar with is your instrumentation recorders.

Kudelski: We make several. They are sold by other companies under their names, except for some for noise which we market ourselves. We make many products that we sell under other names and brands. Under our name, [instrumentation recorders] are mainly for noise vibration, for which people need very wide dynamic range. In the Inter Range Instrumentation Group (IRIG) format, where that isn't necessary, we don't sell them ourselves.

Videography: Why don't you sell them yourselves?

Kudelski: Marketing. You know, we are a very small company, so we cannot afford a marketing system for every product. And there is another reason; my pleasure is to design, to develop, to manufacture, not so much to sell.

Videography: Is there something about Switzerland that makes the Nagra products special?

Kudelski: Yes. You know we have a good population of watchmakers. As watches switch to electronics, these mechanics are looking for jobs. And they are able to manufacture extremely small things quite accurately. So we are making more and more mechanical parts, because we have these people. And we don't want the know-how to die. If the people with the know-how don't work in this field, their knowledge

will disappear.

Videography: Along the lines of making things small, what led to the SN?

Kudelski: When I was a boy, in school, I had no money. 1 made some money by repairing watches. I learned how to repair watches and then I learned how to work with these kinds of things. Without that, I would not have known how to make the SN. There is a lot of watch technology in the SN.

Videography: It was a unique product when it was introduced…

Kudelski: No. There were others which were also small. The Germans made the Miniphone, on wire, which was very small.

Videography: But not with the same quality.

Kudelski: But small.

Videography: The other country that is known for making things small is Japan. Are the Japanese starting to get more competitive with Nagra?

Kudelski: The Japanese are more oriented to very high quantities. We are more oriented to small quantities, more specialized products. But of course, there are a few you have to fight.

Videography: What about other Swiss companies, like Stellavox?

Kudelski: They have the same problem. But they are much smaller, so they are more specialized. We are good friends. You know, I used to own Stellavox.

Videography: I didn't know that.

Kudelski: One day, Mr. Quellet became ill, so he sold me the company. When he recovered, I sold the company back to him. There is a familial resemblance. We look a little similar.

Videography: To get back to the Japanese, have you heard any reaction from Japanese technicians to the VPR-5?

Kudelski: Oh, yes, but I am not allowed to tell you that.

Videography: Do you get a sense that they feel you're infringing on their territory?

Kudelski: You can say the same thing about them; they are working in our garden too. But you see, there are only a few people in this profession around the world. Everyone knows each other. They are fighting and they are sometimes good friends at the same time.

Videography: Let's talk about future plans, as much as you can.

Kudelski: We have many projects in development now, but not all of them will arrive on the market. My problem is finding new pilot customers, people having new requirements. We have a lot of customers who have become our friends, but now they're getting old. They are conservative. What they ask for is what we have already. We need more young people with crazy ideas.

Videography: Are you finding them?

Kudelski: Yes, but not as quickly as I'd like.

Videography: What areas are you exploring?

Kudelski: Of course we have to think about digital recording. We already make a digital instrumentation recorder. But there's a resistance in the audio field to digital. I hope [the resistance] will be eliminated. With the time code recorders, we hope to learn the best way of editing—fast and inexpensively. After we have a good solution, we'll make a version with digital.

Videography: So there will be a Nagra digital audio recorder?

Kudelski: Oh yes, surely. It will be, but I cannot tell you exactly when and which format because that is a problem. There is no format presently that we can use. All formats that exist now are for studio recording. In the studio you have clean air. For a recorder on location, you must use much longer wavelengths because it must work well even in dust and rain and so on. That means that there is no common format for studio and location.

Videography: The DASH (Digital Audio Stationary Head) format doesn't help you?

Kudelski: No, DASH does not work in endurance and uses so much tape. It is possible to use several times less tape.

Videography: What about multitrack?

Kudelski: Same thing, same answer. We already have some multitrack. We think there is a need for a good multitrack small recorder, but we don't know if we have to make it directly digital, which makes it more difficult, or if you can still make one generation of analog [and transfer to digital]. We have prepared both, but we don't know which one we will market. I am waiting for customer reaction.
We can make an eight-channel, 1-inch portable, very easily with very, very good quality. You know, the only superiority of digital is that TOU have no print-through. But for editing, you don't have this problem because you edit quickly. Print-through is a problem if you store tapes for a long, long time. So maybe, for taping, eight-channel analog will be wiser because it is so much simpler.

Videography: Then you'd transfer to digital?

Kudelski: For editing and storage.

Videography: What about digital video? Are you looking at it?

Kudelski: Of course. But I cannot tell you. We can almost look at it. We don't know what the future of digital video is. We must see what it brings to the customer.

Videography: You've seen the various demonstrations of digital video recorders?

Kudelski: Of course. Personally I would prefer high definition, but it doesn't seem that it's possible for broadcasters now. This would be more my pleasure.

Videography: So, you've obviously thought about high definition.

Kudelski: Yes, but we are too small to go in this direction. We are only 500 people in this company. So we cannot do these kinds of things.

Videography: In all the time that you've been developing and inventing, has there been one single invention or discovery by someone else that has made your work easier or made something possible?

Kudelski: Here, we are a team. We work with many people together. We discuss ideas, we also make criticisms. We exchange roles. Everything is teamwork.

Videography: What about outside Kudelski?

Kudelski: In this field, everybody works with everybody. When you build a house, you put a brick on the

brick of somebody else. And somebody else puts their brick on yours. And all together you make a house. It is infantile to say, I invented this, you invented that. It is a common work of all of this industrial world. What could we do if we didn't have insulated wire? It's just for the patent office to say who invented what.

Videography: Is there anything you're waiting for?

Kudelski: Oh, yes. High speed, low power consumption… maybe to make a cuckoo clock.

Videography: Kudelski has five locations, all in Switzerland. Have you ever considered manufacturing outside of Switzerland?

Kudelski: Yes, we have considered it many times. There is a problem in that our quantities are small, so the communication is paramount. Outside Switzerland, especially in Europe, there are customs [offices] which slow down all communications, so it's almost impossible. In Europe, they tried to use air freight, but customs is always there. And they destroy Europe. And many times, they are there just to say you have nothing to pay.
If you send something in the States, from New York to L.A., it takes 24 hours. From here to Paris, it takes a week.

Videography: Has a larger company ever tried to buy Nagra/Kudelski?

Kudelski: Oh, yes. But we are more a laboratory; we are a know-how company. It is very delicate to buy such a company. The value of the company is the team. If the team leaves, there is nothing left, just buildings, machines, laboratories. It is not worthwhile. It is worth only a fraction of the value. The value of the company is people.

Videography: What happens to Kudelski, the company, when there is no more Stefan Kudelski?

Kudelski: First thing, they should spend some money buying flowers. Second, some competitors will be very happy. And then, I have five children: one son works with me here. The other is very excited about physics and electronics. I have three daughters. One will become an engineer, I think. Two of them may be good in business. I don't have any problems, at least in this incarnation.
We also have a team here that can very well live without me. We have some very, very good engineers—as crazy as I am. You must be crazy to do these kinds of projects.

Videography: Thank you, Stefan Kudelski.