# *Dr. Martin Uman: Electrical Engineer*

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INTERVIEW WITH DR. MARTIN UMAN
CHAIR, DEPARTMENT OF ELECTRICAL
AND COMPUTER ENGINEERING
UNIVERSITY OF FLORIDA
AUGUST 14, 1998

*Dr. Martin A. Uman is a Professor and Chair of the University of Florida's Department of Electrical and Computer Engineering. The Department has the largest graduate and the largest overall program in the University. Both graduate and undergraduate programs are ranked in the top 10% nationally.*

*Dr. Uman is generally acknowledged to be one of the world's leading experts on lightning. He is the director of the UF Lightning Research Laboratory. Dr. Uman has written 3 books on the subject of lightning (two now in revised second editions), as well as a book on plasma physics, ten book chapters and an encyclopedia articles on lightning, and has published over 130 papers in reviewed journals and over 140 articles and reports in unreviewed publications. He holds 5 patents, 4 in the area of lightning detection. Dr. Uman received his bachelor's, master's and doctoral degrees from Princeton University, the latter in 1961. He was an Associate Professor of electrical engineering at the University of Arizona in Tucson from 1961 to 1964.*

*Dr. Uman joined the University of Florida faculty in 1971 after working for seven years as a Fellow Physicist as Westinghouse Research Labs in Pittsburgh. Dr. Uman co-founded and served as the president of Lightning Location and Protection, Inc. (LLP) from 1975-1983. LLP, now a division of Global Atmospherics, is the world leader in the sale of lightning detection equipment. Dr. Uman is the recipient of the 1996 IEEE Heinrich Hertz Medal for ... "outstanding contributions to the understanding of lightning electromagnetics and its application to lightning detection and protection." Dr. Uman was named the 1990 Florida Scientist of the Year by the Florida Academy of Sciences. Honored as the 1988-89 University of Florida Teacher-Scholar of the Year, the highest UF faculty award, he is a Fellow in three professional organizations: the American Geophysical Union (AGU), the American Meteorological Society (AMS), and the Institute of Electrical and Electronics Engineers (IEEE). Other awards include NASA's 1992 Group Achievement Award to the Galileo Probe Spacecraft Team.*

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*AM: I'm curious how the International Center for Lightning Research and Testing at Camp Blanding functions, who uses it and so on, and what relationship it has with the University of Florida down in Gainesville. My understanding is that about half of the center's research is commercial and the other half is academic, am I remembering correctly?*

MU: Or 50/50 practical and pure science.

*AM: If anybody just walked off the bus and said I want to use your lightning field what would you say?*

MU: You mean anybody like you?

*AM: Yeah, if I didn't have the University of South Florida (USF) and Tampa's Museum of Science and Industry (MOSI) making the arrangements for me...*

MU: The people would tell us what they wanted to do, in fact they do, some people called us from Europe today and asked what would be involved in testing a lightning arrester. We find out what they want to do and how much is involved and what resources it's going to take and we write them a proposal which says we'll do ABC, make so many lightnings, make your voltages and currents or whatever and in return we need x amount of dollars for graduate students and equipment and whatever. If they accept that proposal they give us a purchase order and the university then collects the money from them when they are finished and we deliver the product they asked for. So the agreement is between the university and whoever wants to do it.

*AM: Okay, so someone might call you up and say I want to see what lightning does when it hits a baby duck?*

MU: Yes, rubber ducks are okay, real animals are more difficult. (Laughter) There's a committee on campus for real animals. (Laughter)

*AM: But you would consider it. You make choices based on the research value because you piggyback your own research experiments or your own data collection on top of every experiment.*

MU: Well, we have several major grants. We have a National Science Foundation grant which pays us $200,000 a year, we have a grant from the Electric Power Research Institute and one from Sandia National Laboratories, so when you add all those up, it pretty much covers the cost of what we need to do. National Science Foundation is all pure science. The other two are more practical. There are bits and pieces of

photograph by Jade Dellinger

Dr. Martin Uman

other things that companies like Georgia Power want to do, or like MOSI wanted to do, and we'll do that if we can fit it into the time and resources we have available. We can only make about 35 lightnings a summer.

*AM: It's not very many.*

MU: No it's not very many,

*HM: Why can't you make more?*

MU: Because we have to wait for a thunderstorm to be right over us and then it only works about half the time so...and it

costs about $1,000. Like last night we fired 10 rockets and had about 5 successes, I'm not sure if it was 10 or 11, it was about 1/2. So we spent about $10,000 for 5 lightnings.

*AM: That's including the ones that didn't trigger...*

MU: Right, we have to pay for those too. It's a thousand dollars per shot. Some days 6 will work in a row, and some days 6 won't work at all. It just depends what's going on up in the clouds. We have to charge what the rockets cost and we only do it if we can schedule a certain amount of hits. Some things we can schedule together if we are going to put lightning into an arrester than we can measure the sound waves from it at the same time, we can do two in one.

*AM: And sometimes I remember last summer, you had somebody there who was doing observations on the lightning from other*

A wind-blown triggered lightning strike, staged at the Camp Blanding lightning research facility. More than 30 triggered lightning strikes are staged there each year, allowing scientists to study how lightning strikes affect power lines, airport runways, home appliances, and other systems.

*people's experiments, do you remember that? He was studying the photography of lightning or something?*

MU: Yeah, he was a visiting scientist from Japan and he had the world's fastest camera, it was an electronic camera we are actually publishing three papers with him now. He's measured the light output of the function of time real fast to see where things go and we measured the currents of the electric fields and we put it all together and made some science out of it.

*AM: But it was actually sort of paid for by the other experimenters.*

MU: Right, he didn't pay anything.

*AM: Oh, he didn't pay anything?!*

MU: He was just a visiting faculty member and he brought his equipment and we got to benefit from that.

*AM: And so did he. So there's a lot of win/win in this lightning field. Had you collected fulgurites before you had begun finding them in your own research center?*

MU: I had a few. I wasn't a serious collector but people had sent me a few.

*AM: Do serious collectors of fulgurites exist?*

MU: I don't know. There are certainly people who will pay 5-7 thousand dollars for a 9" fulgurite, whether that person has a hundred of them or only one. I suspect if a person collects one fulgurite he is probably going to try to collect more. I haven't heard from anybody who is a serious collector. I know with my collecting prehistoric sharks teeth, I couldn't be satisfied with one, I always had to get a bigger one. (Laughter) Bigger is better. Bigger is rarer. I like bigger with serrations with all the original enamel intact...perfect. (Laughter)

*AM: Did you go to Venice (Florida) for the annual Shark's Tooth Festival? I've been to the shark's tooth festival too; the prices work like on a simple graph, like if it's little it's more common and if it's big it's less common! The prices are set accordingly.*

MU: Right, if it's little, a dollar up to $10,000.

*AM: You have up to the really big ones...*

MU: I have ones I paid a hundred dollars for, that you could now get $600 at fossil stores so they are going up in price pretty rapidly.

*AM: So you want to get...you want to be behind the curve on the fulgurites.*

MU: That's what we are trying to do, we are trying to make the market.

*AM: So a fulgurite is a by-product of a lightning strike. It has never been the object of study, it's generally just been by-product that has been collected as curiosity.*

MU: Right, I think geologists have always been interested in fulgurites because they are rocks in the ground and fused sand and in many geology books you can find a section on fulgurites, as you found in your own research.

*AM: I was thinking last night about all this early writing on fulgurites, some of it was done before Benjamin Franklin flew the kite, so what did people think fulgurites were before they knew that lightning was actually electricity?*

MU: I don't know.

*AM: They didn't know about electricity.*

MU: Maybe they didn't know they were lightning.

*AM: I think I read some texts that said fulgurites were always defined as something else entirely. I also found a recent article on something called "pseudo-fulgurites." This fellow found 2 tubes that looked exactly like fulgurites made out of sand grains and they were tubes and they were buried in the ground, and he wrote an article in Rocks in Minerals about these fulgurites and then discovered a few years later that they weren't.*

MU: They were roots.

*AM: Yes, they had been some kind of root encrusted with salt that had then become replaced gradually by sand and calcite or something, and the wood had deteriorated with time, leaving a sand-and calcite tube, looking exactly like a fulgurite, and so he had to write a correction to his earlier story describing his finds as fulgurites ...I have his correction text but not the original story. So I think there was a time when people defined fulgurites differently, just like people never believed in the existence of meteorites.*

MU: The stones they found, even the little ones, nobody believed...

*AM: They thought meteor craters were the result of vulcanism of some kind until really recently, just near the turn of the century did they finally...*

MU: The French Academy, after all the peasants said rocks were falling from the sky, decided at some meeting that it couldn't be... (Laughter) Can't believe the peasants.

*AM: They must have not known about fulgurites, either!*

*HM: Is there any practical use for fulgurites? Can you imagine any conceivable uses for them?*

MU: It turns out that they are created at a very high temperature and they have some physical properties that are different from sand itself or even from normal silicone. So I think

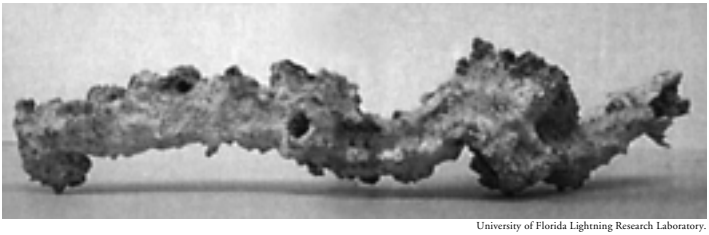
du Pont's interest in lending us these minerals is that maybe something will be created that has some useful property.

*AM: I didn't know that, did du Pont take some samples?*

MU: I'm sure they did.

*AM: I didn't know that.*

MU: You know, we have a lab on campus that analyzed some of our fulgurite samples and they have different electrical properties than what you think of with normal glass It may be that you burn something as hot as this is being burned it just recombines into some structure that has some property that may be useful.



University of Florida Lightning Research Laboratory.

An excavated nine inch section of a natural fulgurite.

*HM: Would that be something du Pont might explore rather than someone in your department?*

MU: It could be either. I think it's not a high priority item for anybody.

*HM: Right.*

MU: You can't train a student in fulgurites and send him out and have him get a job.

*HM: Right. So in a way, the research is part happenstance, you look at something, but no one's going to do a big study.*

*AM: Some have been done. I don't know what you would call a big study, but there are a lot of historical texts in journals printed early this century, with drawings of the structure of fulgurites.*

MU: Mostly geologists.

*AM: So, when I met you I already knew something about your work through Discover Magazine...*

MU: Young as we were then...

*AM: Right, young as we were...*

MU: (Laughter) Last year...

*AM: You have just ... how long ago was it that you discovered that lightning continued into the ground?*

MU: Nobody knew how far the fulgurite went and what properties of the soil allowed you to make a fulgurite. There may be lots of places where lightning strikes the ground and the soil just won't make fulgurites. In fact we put stuff in tubes and we couldn't make fulgurites. Like wet soil.

*AM: But you sort of already knew this before but you hadn't tried it.*

MU: I don't know that we knew that.

*AM: Really?*

*HM: So would that be pure science then?*

MU: I think more or less. It's become art, but yeah,

*AM: So here it's no longer science! (Laughter)*

*HM: What's your definition of pure science?*

MU: Knowledge for the sake of knowledge without obvious applications, or not motivated by practical application.

*AM: Science for science's sake.*

MU: Except science models the world, so we try to put equations together that fit reality. Turns out it's just like art. Art is for art's sake, but it tries to at least model the artist's view of the world instead of the objective world that is really supposed to be there but may not be there. (Laughter)

*HM: Do you think pure science is actually the moment when science realizes the tenuous nature of an objective world?*

MU: At any level when you try to understanding anything, it's clear we don't understand it well. At any level when you try an equation for something or draw a picture of it, there's another layer underneath, you never get there, all the atoms and whatever else are out into the cosmos and what was before that. I think the pure scientists know best that they are never going to understand what real means. It'll turn you into an artist, right? At least what you do is real. (Laughter) What you want to do, it's your reality.

*AM: Driving up here this morning Helen was talking about how she enjoyed your once mentioning that after you thought about something as much as possible, there was still something you couldn't figure out. Isn't that what you meant, more or less? And she finds by writing about art, that some art is...you can explain absolutely every reason the artist did everything and it makes sense as a package – but not always as art.*

MU: Might be completely wrong, but it makes sense.

*AM: True, that's what she said.*

*HM: I find I don't depend on a right or wrong quotient in art.*

*AM: My observation is that art museums try to exhibit the artworks in their collections as if their values and their meanings were factual. They borrow display conventions from natural history museums as if to say this artwork is a fact, this is in fact a great art work. And yet it's largely a matter of opinion, what's valuable and meaningful, and the art of running a museum really involves a lot of simple taste-making. But they try to convince themselves they've made an objective choice...*

MU: But in the end you decide what is art in that process. Out of the millions of different paths that could be built on, different styles and movements that could be chosen. The reviewers or the art critics or the museums define what is art.

*AM: Is there something like that going on in science?*

MU: Well, anything you do someone else can repeat, and if it doesn't work you know about it, and throw your conclusions away. If it works you can go deeper and deeper, so it's more objective.

*AM: That's become sort of a touchstone for me as an artist, also, I make art that can be repeated...it has to be repeatable.*

MU: A lot of people would agree that if they went into a museum and saw some abstract painting, what they would think is that it was balanced and the color was pleasing to the human mind and you could get 70% of the people to agree that that was good...I think...maybe I'm wrong

*AM: Sociologists have done experiments like this, take a statue into the jungle and see what the local tribespeople think.*

MU: But then the people in the museum pick the weird stuff that's hanging on the wall. Like 'this is a good one' and then everyone would go in and say, 'Oh my god' and then years from now we will look at the stuff hanging on the wall and say

wow that's really good. (Laughter) It's been around and we are used to it.

*HM: The museum lends a lot of authority to the decisions people make, like curators for instance. Is there an of institution similar to a museum in science that gives it its credibility?*

MU: Like journals, real high class journals that have very good reviewers that review your work, and you get published, and everybody assumes it's probably right because it's been reviewed and the standards are pretty high. And then after that everything you do will be approved with less proving because you will have done something similar. If you get your painting hung in the MOMA you can do real crap after that. (Laughter) People will buy any Picasso sketch no matter what it is, and it's worth $10,000. It's a scrap of paper. Present company excluded! (Laughter)

*AM: Thank you, we hope so. We know nothing you do is repeatable! (Laughter) It's all sort of accidental in the first place, even the lightning that's triggered artificially.*

MU: Right, I realized it was completely different, so when we do something we have to do a number of lightnings to get what would happen on the average.

*HM: Do some scientists view what you do with a kind of skepticism because you can't repeat precisely?*

MU: It makes it more difficult to get to decisions about what's going on. There's more doubt.

*AM: Like trying to figure out if the world is getting warmer or not... years and years to find out.*

MU: And that's so politically charged. People stretch the truth on either side to make their point, use selected data.

*AM: Do you run into these kinds of problems when you do work as an "expert witness" in trials that involve lightning?*

MU: So then it depends on the jury, like the case coming up next week about the soccer player that was killed on the field. The issue there was we know where all the lightning was, and can we convince the jury that we know where the lightning was and then will they believe, if they believe we know where the lightning was, that everybody should have heard thunder and the coach should have gotten everyone off the field.

*HM: Holy cow, so they are suing the coach at the university?*

MU: For not knowing that there was a severe storm warning, stuff like that, buildings that burn down, the question is was it lightning or something else? Part of that is investigative, and then part presenting your evidence to the jury and the other side will have an expert that will say it wasn't lightning, just gasoline or something.

*AM: How many lightning experts are there for these trials?*

MU: Oh, I think there are about 5 in the United States who know what they are doing.

*HM: So you are part of a network then...*

MU: A fairly small club. Every industry, every power company has a lightning expert, but they are fairly narrowly focused and they know how to do what their industry needs to do.

*AM: You work for the victims and the insurance companies?*

MU: Pretty much whoever calls, I give them my opinion. If they don't like it then they don't use me.

*HM: Are you paid for testimony like that?*

MU: Yeah. You can be subpoenaed. Then they pay your car fare. Usually one side wants to pay you because they want you to be friendly.

*AM: Now, you've collected fulgurites for some time, you started out with two or three that were given as gifts from friends...*

MU: Several were from Phil Krider, at the University of Arizona, that a geologist at the university of Arizona had collected. Another friend sent me one from Texas for Christmas once, Leon Byerly.

*AM: So, when was the first time that you realized a fulgurite could be used to help you determine data for your researches?*

MU: The experiment was being done already by another group, to look at how currents go in the ground around power cables and how much voltage is produced, and the drawing of how the experiment worked showed a current hitting the ground and all of the current spreading out. That was the drawing. They were going to look at the current and voltages. When we excavated that thing, we found out that all the tube went down into the powerline and put the bulk of the lightning current right into the powerline, it was like the earth wasn't there. That was a major sort of discovery.

*AM: At that point, when you began to see them as a trace of the lightning's path, which was useful information, your appreciation of the sort of surplus value of a fulgurite was enhanced, as well? That a fulgurite is also a beautiful and amazing oddity, so you started unearthing them and keeping them and showing them to people?*

MU: Collecting.

*AM: Collecting.*

MU: The art of fulgurites.

*AM: The fulgurites in a sense are like an art work, in that they sort of arise out of practical study and productive work, as a useless beautiful object...*

MU: Sort of like a piece of coral. I mean coral is made by animals in some random way and the animals die and you have this beautiful piece of rock. It's the natural residue of a natural event which in this case is electrical.

*AM: It has no real scientific value except in this case it pleases people.*

HM: But a fulgurite is a pretty curious aesthetic object. They are not at all beautiful in the way your landscapes paintings are, for example.

*AM: They are beautiful because they are cool.*

MU: They are beautiful like coral is beautiful, or like a rock, say you find a sunburst where you have these circles of color coming in.

*AM: The fulgurite actually represents the path of lightning, and lightning is what you study, it's kind of a beautiful by-product of something you are interested in. Do you think that adds the value?*

MU: Surely it obviously means more because I know more about it.

*AM: If you didn't know it came from lightning you wouldn't, it wouldn't be so remarkable to look at.*

MU: It's like a lunar scientist having a rock from the moon. The rock would mean a lot more to him than it would to Joe Schmo.

*AM: When did you start painting in relation to when you started thinking about fulgurites?*

MU: I started painting in 89 and I think we made the first fulgurites in 93 or 94.

*AM: Do you think being a painter has sensitized you to look for qualities in the landscape that you wouldn't normally be looking for as a scientist?*

MU: Well, I definitely know it did that. It makes me examine everything to figure out what it is, but I don't know if I can apply that to fulgurites or not.

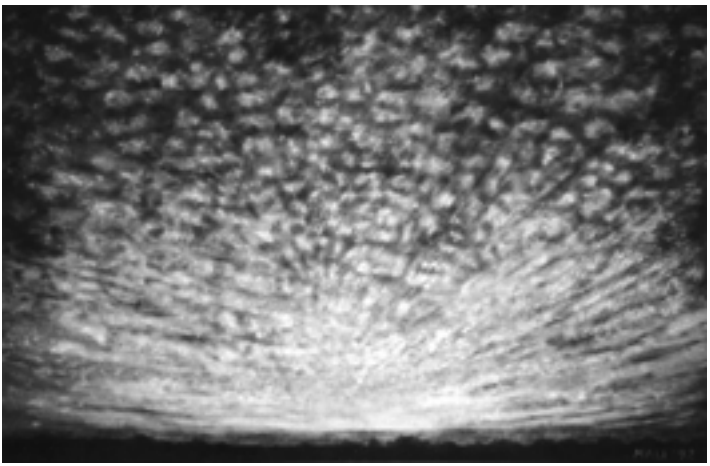
*AM: What about your cloud paintings, your clouds are kind of unique, and they are articulated...*

MU: The clouds are modeled after real clouds, where if you look at paintings in the history of art there were styles that you were supposed to paint clouds which had nothing to do with clouds, just like there were styles you were supposed to paint bodies, where your eyes were supposed to be in respect to your mouth, and everybody did them the right way, the academy way. There were faculty who came into our office, and when you come in our office on the right side there is a sort of cumulus cloud with a beach scene, some palm trees, and the guys said that is a very unrealistic cloud, I have never seen clouds like that. I said, have you ever looked at clouds, and he said I have, I've been sailing all my life, I've looked at clouds. I said, well you go out and look again. And he came back in 3 weeks and said, gee that's exactly what clouds look like. He had this picture in his mind of what clouds look like. So there's nothing great about doing clouds right, but there's no reason not to do them right, and since I know what they are.

*HM: Now you are a lightning expert, but are there cloud experts?*

MU: Yes.

*HM: Is there a lot of talk between you?*



Martin Uman. *Sunrise altocumulus*, 1992. Oil on canvas.

MU: Some, but not a whole lot, at the same conferences they sort of come together. The lightning starts in the cloud and then there are people who worry about the charging of the cloud. There are different people by in large, but some of them overlap and we can understand what the other person is doing because it's important to do that.

*HM: So interdisciplinarity is a buzz word in the humanities right now, is that something that's going on in your work?*

MU: Oh yeah, it's something the national societies give away money for. Right now we take a student from four different engineering departments and put them together on a project so they can learn team work.

*AM: Does your knowledge of how a cloud might be charged with electrical currents change the way you paint them?*

MU: I don't think so. But the fact that I know how the cloud is forming and where the winds are going, and what's ice and what's water.

*AM: That affects the way you represent them?*

MU: Well, ice looks different than water, so there are different parts of the cloud that have different textures. Ice is sort of stringy and water is bulgy.

*AM: So the cumulus are water.*

MU: Well the upper parts of cumulus are all stringy, and that's where it turns to ice.

*AM: And cirrus?*

MU: Yeah, cirrus are all ice.

*AM: I only knew them from school in terms of their shape but I didn't know their physical constitution. Why is it that there's no lightning in any of your paintings with big skies? Considering that's your field to study lightning.*

MU: Well, I think it's corny to have something that's a transient effect in something that's a natural landscape, it's kitschy, the landscape is always there, it's eternal, and it's sort of a transient event and it doesn't seem to be right.

*AM: So you wouldn't put in a bird either?*

MU: Well occasionally a bird, but birds are there for a while. (Laughter) So I guess it's a question of time. I only put the birds in for scale, I wouldn't put a bird in if I didn't have to to show the size of things. (Laughter)

*HM: But the clouds are transient too! (Laughter)*

MU: Yeah, you're right, I'm full of crap! (Laughter) I had better do a lightning just to scale the transientness. I don't know why I don't want to do the lightning. Well, because I think it's corny.

*AM: Is it corny maybe because you're an electrical engineer?*

MU: It may be corny because I am doing that business, and it seems corny, but if I didn't know anything about it I might try to do lightning.

*AM: You don't want to be like, 'Oh, he's a lightning expert and he also paints lightning.'*

MU: No, it's not why I don't do it, but I can't explain why I don't do it.

*AM: Allright.*

*HM: I wonder if you know actually so much about lightning, too..*

MU: I could paint a good lightning but I don't know if it tells us about the scene that well.

*HM: I think it's about the translation from the event to its representation.*

*AM: Your style of painting is not that spontaneous, it's more methodical...you develop a look at something over a period of time, you're not an abstract expressionist.*

*HM: Yeah, it's not a quick brush stroke.*

*AM: Yeah, and maybe if you painted with watercolor, or with quick brush strokes, the technique itself would convey the idea of a momentary phenomenon that just lasts a second. Every brush stroke...*

MU: I could then put in a Zorro lightning and be done, maybe... (Laughter)

*AM: Ok, ok...*

MU: ...but right now if I did a lightning it would have to be a thing with branches because I know what lightning looks like it would have to be very accurate...

*HM: I don't recall from studying your paintings any nocturnal scenes. Did you do any?*

MU: They are not in the office, but I have done some with bluelight features, and I like the water. I've also done a bunch of abstracts which you haven't seen. Some of them are pleasing. Some my wife even likes. (Laughter) She likes other things, she likes some of them, but not the same ones I like.

*AM: So what's the percentage that she likes?*

MU: Well, I would say we both like maybe 1 out of 10, but It's a different one. She has things that resonate with her background and I have things that resonate with mine. But also I know what I am trying to do, but if it works I have a feeling that if it's put together, I know it and I stop, and then she says, that's not green enough, or that's too green.

*AM: But you don't go back and change it because she said so.*

MU: Occasionally, if her point of view makes sense with what I'm trying to do.

*AM: So when it all comes together, how often does it happen with painting? Do you have to throw away 20 to get one or does it happen with every painting, or...*

MU: Well, I don't throw them away but I would say 1 out of 10 sort of works, but I don't know why in the beginning. I have a form and ideas and I sketch it in charcoal and start painting on it and start changing colors and quite often it's a different color set at the end because the color just didn't look right, and sometimes it just fits with me, so I like it which gives me great pleasure.

Martin Uman. *Santa Fe Doorway*, 1995. Oil on canvas.

*AM: At that moment. Does that moment last?*

MU: Actually, at that moment. That moment. Actually I got a couple of paintings on my wall that I still like to look at, and it's been years – but no, not as much as the initial moment, the initial moment is really great it's, like making a scientific discovery. Feels good like getting straight A's

*AM: Does that feeling last?*

MU: The straight A's?

*AM: The elation! When I worked in the field with you guys last summer triggering the lightning, the times I felt most comfortable and excited, and what seemed most familiar to me, was when we were working out the designing of the experiment itself, like when you came up with the two bolts idea, to help me form a terminal sac at both ends of the fulgurite, and guessing at whether or not a lightning bolt would necessarily jump a 7" gap without a leader to follow, and how Dan Cordier came up with the PVC pipe ideas, and how it was all going to work, and Mike Stapleton figuring out how the wire was going to trail away from the rocket when the launcher 12 feet from my bucket, and came up with the idea of the bungee cord to absorb the snap of the wire, that to me felt creative in a similar way to how it is in the studio, where you are usually trying to fit something together with something else, philosophically, emotionally, and technically. You don't know if it's going to work and maybe everyone else will think that looks great and you will think that it looks horrible, and you know, what you want and a certain kind of feel that has to do with more than just measuring things. So I wonder, do you feel any similarity between designing an experiment and making a painting?*

MU: Not really, there are so many constraints when you design experiments, not that I don't get the same kick out of doing an experiment. I don't know what that is.

*AM: Designing the fulgurite experiments on the run, for me it was like that movie* Twister*, where the scientists are grabbing the aluminum cans and racing their vans all over the place, and they are cutting up little propellers out of Coca-Cola cans, and whether they are going to get the right results all the time…I felt that there was a little sense of that. In the past I always imagined that scientific experiments are done with elegant instruments with stainless steel surfaces and all the wires are in place and hidden, and then you find out that scientists also fabricate things made out of duct tape and masonite and string!*

MU: It's probably true, and the tornado business and lightning business are probably more like that with duct tape and string. The tornado movie is okay, if they made it accurate about what you could do and the risks you shouldn't take, I mean, people don't do that sort of stuff. It wouldn't have been that exciting.

*AM: So you don't go out and get drunk and throw beer cans at lightning? (Laughter)*

MU: No...

*AM: When you make a painting is there a systematic period where you are designing it and putting lines where you are going to put the paint and determining the composition. Do you decide a lot before hand and then just sort of fill in?*

MU: Decide that before hand, and then right, try to block in the colors. But usually it doesn't look right or something looks not balanced or structural balance comes first and color comes last, it's a little bit of moving things around and changing the shapes of things, like if a palm tree is not big enough on the other side there's water, I don't know why it doesn't look right...

*HM: So you are not being faithful to nature. (Laughter)*

MU: I start being faithful like I've been doing a lot lately around our pond, I start adding trees, subtracting branches from other trees, putting red in the sky when there isn't some.

*HM: You are in a venerable tradition, painters have done that for centuries. (Laughter)*

*AM: Now, with the fulgurites, you started out studying underground power cables and how lightning enters the cables and you moved to fulgurites then you moved to collecting fulgurites that weren't associated with experiments, and then you worked*

*with me on an experiment involving fulgurites, and now your staff is out there making these PVC pods and making fulgurites for no reason except the pleasure in it. The lightning experiments started out with a clear scientific purposes, but it's developed some fun and emotional legs of another kind, you and the others aren't only out there to collect quantifiable evidence, you're collecting other stuff also!*

MU: When we open up those tubes it's a real moment of discovery, everyone's there.

*AM: Yeah, and everyone rushes around to see what's in there?*

MU: Is it crooked, is it straight?

*AM: Yeah because you never know.*

MU: Maybe it's like these artists that drop explosives into holes with metal, and it just kind of blows things up. And they bring the metal out and hang it on the wall.

*HM: To me what's so fascinating is that you have a bunch of guys out there doing research whether it's pure science to figure out what lightning does to different types of underground fixtures and home appliances or whatever, and then you have guys out there doing it for fun. What I am curious about is when the lines which divide being a scientist and a curious hobbyist get blurred. You told me that one guy filled the tube with marbles and I thought, that's fantastic, it's like being 8 years old.*

MU: We haven't figured out how to afford to see what diamond does. (Laughter)

*AM: A friend of mine found a book about the tribes of people in Africa who actually wear fulgurites around their neck.*

MU: It's supposed to increase your sexual power. In some places they sell them to communicate with animals and extra-terrestrials...

Martin Uman. *Cow #2 After D. Patterson*, 1997. Oil on canvas.

*AM: I've seen that in a book...*

*HM: You tried?*

*AM: Oh yeah, it works. (Laughter)*

*HM: It is very X-Files at Camp Blanding.*

*AM: There actually was an X-Files episode where a fulgurite provided a clue to a mystery...*

MU: People are always afraid of lightning, it is the fire of the gods. People make their decisions based on what the lightning looked like and where it was. Everybody is scared to death. So if you got the trail in the ground, then you ought to be afraid of it and think it has magical powers.

*AM: Where do we come in...triggering lightning, have I collaborating with you or a higher power? How did my coming here with this project affect the other people who were*

*working at the research facility? Did they become more interested in fulgurites?*

MU: You gave us a whole different slant on the world. We've never seen a world famous artist before here...you have different ways of looking at things than we do, you knew what you wanted roughly but you still are not sure what you are going to do eventually, on the tables in the art museum, or what. For a long time you were rearranging, finally you settled on zircon, you didn't know if you wanted terminal sacs on each end closed rather than opened.

*AM: We had to 'design' that double terminal sac.*

MU: You motivated everybody to think about what was going on and developed a ground launcher, which we had never done before, that would put lightning in a bucket next to it, and tried all different materials most of which you rejected because they weren't aesthetically pleasing to you, which is amazing to us because most of them were aesthetically pleasing to us.

*AM: Oh yeah, totally it's just that I had my own idea.*

MU: That's interesting to us.

*HM: Did you find the final fulgurite not so aesthetically pleasing?*

MU: I wouldn't have chosen it. You chose a simple one with a little curve...you chose it for various reasons. I would have chosen a more complicated one, but I wouldn't think of having to make a mold or anything practical.

*AM: What was all this about the guys out there making extra pods? Dan's still got a 20-foot tube ready to go right now!*

MU: In fact he blew a tube apart last week. He had the first tube of the summer and lightning blew it to smithereens. It came apart...

*AM: He didn't tell me that, it must not have happened when I saw him last.*

MU: Probably not, it was a failure. It certainly motivated us to figure out how to make them, we were originally going to make them all in the ground, we were going to dig holes and pour dirt in there and then somebody got the idea of tubes...Long tubes...different materials, and the guys were very inventive, came up with all these schemes, just filling them, they are very heavy, filling them and unfilling them so you don't lose the stuff because it's very expensive. How do you saw open the tubes? (to HM) It's a very complicated operation, Allan and Jade were there digging, constructing, sweating, right there with us.

*AM: One day I showed up there and it had been a few days and the guys had made a necklace of pods after Dan's and my model, and they were all strung together and they were piggybacked onto other people's experiments.*

MU: Right, before Florida lightning got to something else, it was going to make 4 or 5 fulgurites. (Laughter)

*AM: What have they done with those things?*

MU: There's a room there in the Center, there's lots of them. Dan's got some at home and I've got some at my house.

*AM: And what do these engineers they call their operation?*

MU: "Lightning By-products!" So we made a deal with the university that what was left over we could sell, if we gave the university a cut, but it's supposed to be what's left over. Not supposed to be making them specifically. We drew a fine line there. But if the University of Florida gets its money like it does for Gatorade, for example, when we start making billions for the university they won't care if we start making them primary or secondary!

*HM: So what's going on out there is it science or pure science?*

MU: What do you mean?

*AM: She wants to know where the line is.*

MU: The line of what? Science and hobby?

*HM: Yeah, the guys out there piggybacking...*

MU: Making fulgurites is just fun and it's aesthetic. There may be some reasons to do it, and the people at du Pont Mines may think there's a reason to do these things because they think something may come out of it. It may be a rationalization for the Managers at du Pont. I don't know. They may actually believe it. Everyone's having fun, everyone likes to come out and watch the rockets get fired.

*HM: Is there something else in your scientific career that's been fun in this sort of goofy useless way?*

MU: Yeah, I've done a lot of things that aren't plausible. I've done a lot of things on Saturn rockets, the Apollo series, and exhaust trails, and other people and I were down there for launch after launch in the middle of the night, and it was the closest to being at the end of the world. The rocket was two times as big as the shuttle. Norman Mailer has an essay about seeing the Saturn rocket go off. I heard him reading it on NPR the other day. It was incredible. It was a great experience. His soul was shaking. I did that.

*HM: But the fulgurite was useless.*

MU: It was useful what we did, but the fun wasn't getting the data, the fun was being there with a bunch of people who were doing the same thing and could scream and yell about an exciting experience, and we do that about the rocket, when the rockets went up everybody screamed

*HM: I can see that. It's like being at the drag races.*

*AM: So is there some sense that you may have chosen this career path because you like being around lightning, is there any kind of truth to that?*

MU: Oh I think probably, I got started when I was in Arizona and there were people doing lightning research that I had been associated with, and I think I probably always liked to look at lightning and I like to be outside, that's fun.

*AM: I was thinking it's very difficult what you do because you are looking at an extremely powerful event that can in almost no way be perceived without the inevitable symbolism, without drama, you can't just neutrally stand there and watch a lightning bolt or some other kind of experiment.*

MU: I wish I'd said that, that's good. (Laughter) Yeah, it is, it's the brightest light in nature, it's the loudest sound except for some unusual things like an earthquake, it's an event that is overwhelming.

*AM: So do you ever forget to run and turn the equipment off because you are so in awe of the bolt you've just seen, or so stunned, or...*

MU: I don't think so, but yesterday, there's 5 seconds and this one struck in the middle of the field and the thunder was really loud and everybody said, "Oh, wow, fantastic!!!" So you take 5 seconds off to be really awed and then go back to pushing the buttons. I think that's what happened, and the next thing I did was ask over the walkie-talkie if that recorded on the equipment. The more you know about it, the more amazing it is, the more things you can see....

# *THE EVENT*

## *PETRIFIED LIGHTNING FROM CENTRAL FLORIDA*

A PROJECT BY ALLAN MCCOLLUM

CONTEMPORARY ART MUSEUM
UNIVERSITY OF SOUTH FLORIDA

MUSEUM OF SCIENCE AND INDUSTRY
TAMPA, FLORIDA