

Understanding Laser Accidents

Professional Ways To Killer Laser Shows



A Conversation With

Ken Barat

With Tim Bennett

Of ArgonTV

**Understanding Laser Accidents
Professional Ways To Killer Laser Shows**

The following is a transcript of an interview between Tim Bennett ([ArgonTV](#)) and Ken Barat ([On LinkedIn](#))

If you work with lasers, then this is for you...



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Understanding Laser Accidents – With Ken Barat

Tim Bennett: Understanding laser accidents, why they happen and how to prevent them, is our topic today in our chat here on ArgonTV

If you are involved in laser technology, whether it be in a laboratory or in live events, then this call today is just for you, because one of the reasons that we all started in the entertainment industry, was to make people happy and give them fun and enjoyment.

It wasn't to create hazard, it certainly wasn't to hurt anyone...

So laser safety is a big hot topic here at ArgonTV.

I'm being joined today by a very unique and rare man, Ken Barat, who's the author of a book called "[Understanding Laser Accidents.](#)" he's also an LSO, a certified LSO (Laser Safety Officer) and he's written many, many articles all around the place talking about laser safety.

In fact, instead of me telling the story why don't we just meet Ken directly?

It gives me great pleasure to welcome Ken Barat to ArgonTV, author of "[Understanding Laser Accidents](#)" award winning gentlemen, ladies and gentlemen, please welcome Mr Ken Barat...

Ken Barat: Ah Tim, thank you so much and I hope you can hear me over the applause that I'm sure has been generated by my introduction... so that's just great, I'm very honored and excited to be here.

I think laser safety needs all the publicity it can get, so i'm excited to be here.

Tim Bennett: Excellent and thank you for joining us.

I really appreciate you taking the time to be here with us today.

And how I found Ken, was I was looking on the internet, I was on Google...

I was searching for information about laser safety, and I was looking for something with a slightly different angle, because all of the information out there seems to be the same important information, but it's repeated over and over again.

So I thought it'd be great just to find something new and refreshing and I [found Ken's book](#) and I went to Amazon, checked it out, had a look at it and indeed it looked like a very fresh new approach...

And in a moment we're gonna talk directly about the book and what to expect from it, but first, let's just meet Ken himself, maybe Ken you could just give us an introduction to you, don't need to go back to your birth, but what you've been doing in the last... you know, a few years with lasers.

Ken Barat: Well, so sort of very interesting at least at least to me, I used to be involved with the state of Illinois... involving radioactive materials and outside of Chicago there is an [OSHA Training Center](#) and as a state employee, I was allowed to take courses there for free.

So I took a number of courses on lasers, vacuum, ultraviolet, what you could say non-ionizing radiation and I just thought lasers were the thing that was coming up and that's what I needed to know about and then sort of from that I had an opportunity to work for the state of Arizona.

My wife was tired of minus 80 wind chill in Chicago and got herself a job in in Arizona.

So off we went and through a number of things I became a head of the non-ionizing group in the State of Arizona.

I say the head of the group... it was a one-man operation, so you know pretty short chain of command.

We developed a non-ionizing program a laser regulatory program to get a... to improve laser safety in the State and from success of that, I was approached by a Lawrence Berkeley National Laboratory, the Department of Energy's oldest research lab, it's sort of a a basic R&D and so I went over and worked with them for many years and just got heavily and heavily more involved in lasers and laser safety.

So that's kind of how how things went for me.

How I kind of fell into lasers, but when I was in Arizona I was also, part of my job was inspecting laser light shows.

So I got very involved with the live laser entertainment community in the state and you know companies coming in from entertainment, to also a lot of Laser shows at business, annual business meetings.

So I got very familiar with a lot of the ballrooms throughout the state and so I just sort of a broad background in in dealing with lasers and looking at it from a laser safety perspective.

Tim Bennett: So WOW!

That's absolutely fascinating.

You you sound like you've had a huge range of experience in so many different areas working with these groups, but you became a laser safety officer when?

Ken Barat: Back in about 1990 or a little bit before then so it's been quite a long time.

Tim Bennett: That is a long time.

In fact I started with lasers in 1989, so that's almost my whole career!

Yeah I bet you've got a few stories to tell in that time as well.

Ken Barat: Yeah I mean on one hand particularly working for the part... US Department of Energy... I've been involved in, you know, from the safety aspect, but involved in some of the major research projects in the United States Worldwide.

The very start of the [Human Genome Project](#), which everyone now talks about DNA sequencing like it's nothing, but then it was a major effort, laser fusion laser acceleration, all sorts of odd things.

So I've met a lot of exciting researchers and it's really been a real pleasure for me.

I did get my original degree in chemistry and soon realized I was not going to win the Nobel prize, so getting to help these other people, who could very well, was sort of a nice thing for me.

Doing laser light show inspections was a lot of fun, met a lot of fun people, interesting situations...

I had sort of an experience with Paul McCartney when he was touring his Paul McCartney and Wings that I found interesting, but you know, I don't know how other people do, but he was... they were doing their...they had the act was in... Arizona State University, they have a huge outdoor arena, a stadium and so I

used to always show up before, you know, before the show would start, so I could look at alignment, how things were set up and all of this nature and so the whole infield they had filled in with seats and so I'm sitting, you know, in the middle of the stadium and you know, the seat... the only one in the infield who's sitting.

Everyone else is setting things up on stage or running around and all of a sudden McCartney and Wings come on stage, they're doing a sound check and you know I'm saying, I'm a big Beatles fan, so I say well I can stretch out my diagram, that I'm drawing and just sit in and enjoy you know, the music and about 10 minutes into this, I have this rowdy comes up to me, a roadie comes up to me and he says *"can you please sit somewhere else?"* and I said *"well what is the problem?"* he says "you're disturbing Paul.

He says looking out at a hundred thousand people is okay, we are looking out on a 100 000 seat auditorium and just see one guy seemed to be a little bit unnerving to him."

So I said yes *"I can be nice, I can move"* and you know or all of that, but that was my experience with Paul.

One the few people who's probably made him feel uncomfortable in an entertainment venue.

So that's sort of with that, but I don't know things like that!

Tim Bennett: Yeah and I think that's one of the things that makes this industry so fantastic, is the stories that you can look back on that you know, normal jobs just don't ever have.

You know go into a... being a secretary going to the same office every day, doesn't have the same fun element to it, and I must admit, it attracted me to the industry as well.

Ken Barat: Well I will have to give McCartney a plus, because about two years before that, when I was doing laser light shows for the state, I tried to get anyone in the office to come with me and learn what they needed to do and as soon as they found out that this was all off hours, you know nighttime work and there was no compensation either comp time or extra money, you know these are all government workers there, nobody was, no one was interested and then as soon as they found out that there were lasers on the McCartney show, I had a line of people at my desk asking to take advantage of my older offers, you know, previous offers, but you know, I said *"hey you had a chance you know, life's tough that's about it."*

Tim Bennett: We did an [event with Coldplay](#) here in the Philippines about two, three years ago and once people found out that I was actually helping them with the lasers, it was amazing how many new friends I got.

Yeah, so great and it's great to hear your your beginning in lasers and everything and as I did mention you are award-winning as well, so what are the awards about?

Ken Barat: Oh what were the awards about?

I... the Laser Institute of America gives out a [Jim Rockwell Award for laser education](#), so I won that for my promotion of education with lasers, there's the advanced light source, which is a synchrotron type of accelerator, they give out an award for service to the user community, so I won that and you know related type of things, so very honored very appreciative of them, but yeah, that's sort of it, probably the least interesting thing to people about what I do is that, but meant a lot to me.

I was very excited about them.

Tim Bennett: Excellent and it's not quite the Nobel Peace Prize that you wanted, but you know, we all take awards.

Ken Barat: I'm working my way up.

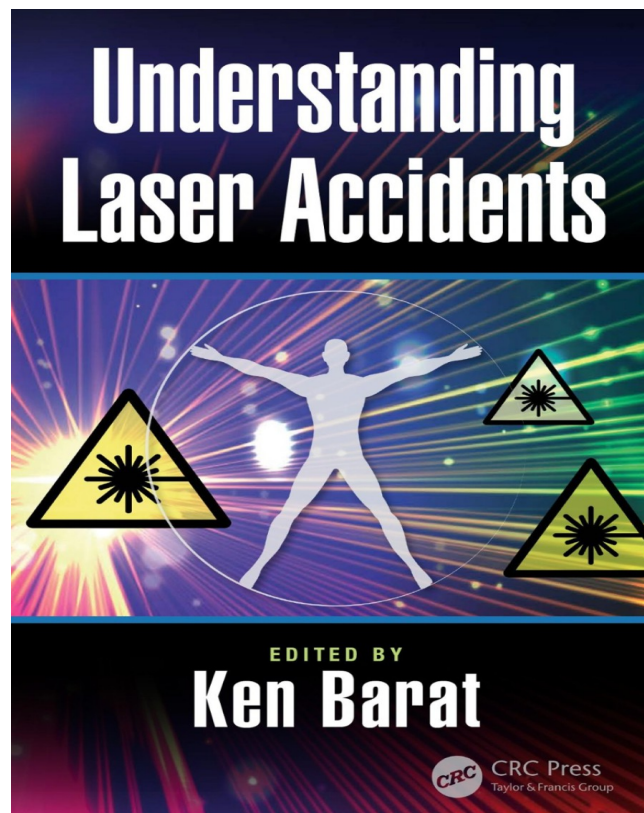
You know this is... what what can I say?

Tim Bennett: Excellent, excellent, well let's just take a quick break...

I am here talking with Ken Barat, he's the author of an amazing book called "*Understanding Laser Accidents*," don't go away... because we're going to talk about that book in depth right now, so we'll be back in just a moment.

Understanding Laser Accidents

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Tim Bennett: So welcome back, we are talking to Ken Barat, he's a very fascinating man, he's had years of experience in laser and laser safety more importantly, and he's written a book called "*Understanding Laser Accidents*," which is what we're going to talk about today.

So my first question is, are there that many accidents Ken, that we actually [need to have a book?](#)

Ken Barat: Well you know, it's an interesting question, because there are about 20 societies and organization and regulatory organizations, that say that if you have an accident, they're interested in getting information about it, but when you query them and say well how many people have voluntarily reported that they had an accident, the numbers are extremely small and and the number, if you, the Department of Energy is probably the premier organization on tracking accidents and documenting them and investigating them and when you look at the number of accidents, per the number of users or hours of use statistically, it's in the noise, but the fact is, the severity is you know can change your life if you get an eye injury and you lose 20% of your vision, that's, you know, that's traumatic.

There are a number of accidents that have occurred where people have had minor effects from it, but overall, you know, how many are happening it's hard to say, but I don't go to any meeting... I go to there are always, you always hear anecdotal stories about accidents that have occurred.

So are we having one a day?

I don't think that's the situation, but like with any type of accident, you know, one is too many.

The ones we hear the most about are pilot illumination.

Aircraft being hit by... aircraft, helicopters being hit by lasers.

Two years ago in the United States, we were having seven thousand a year.

In 2019 it dropped down to 5,000, but that's a tremendous number when you think about... even though the damage and the airplanes doesn't happen and pilots are more annoyed, than getting actual eye injury, but still uh that's a big number.

Tim Bennett: 7,000 is absolutely huge and that's just one country.

I know when... as I say... I mentioned Coldplay earlier, when we were talking to the Aviation Authority In The Philippines, because the stage area was right in a Cathay Pacific flight path, they were saying that in the Philippines there are many many instances, not just lasers, but all sorts of sky trackers and fireworks and all other things going on and they really need help in bringing this to people's attention.

Just going back to one of the things you said just now, was that there are not so many... not as many incidents reported.

Do you think that most people that don't report, do it because out of fear of some repercussions from that or is it just not needed to be reported?

Ken Barat: Well you know, it depends on the setting.

If you're... universities researched, most accidents, you know, wind up happening to graduate students and there's a reluctance of grad students to say anything happens.

They think it's going to affect their careers.

Universities don't like to announce, *"Oh we just blinded, you know, your son or daughter, you know, look at us."*

They don't want that.

Same thing goes with medical institutions.

They're always worried about malpractice and publicity and same thing goes with large industry places.

So it's a mixture of trying to avoid negative publicity and also there's a certain amount of confusion on who to report to.

So in the United States we have what we call OSHA (Occupational Safety and Health Administration) so if you have an accident, you're supposed to report it to them, but keep track of those things.

You can actually go to an [OSHA website for laser accidents](#) and they've got less than 30 over 50 years.

That just doesn't sound reasonable and when you read through the 30, most of them are equipment containing a laser, but it's not a laser injury, it's mechanical!

They got hit by the robotic arm, but not actually the laser.

So there's that... In the United States, The Food and Drug Administration has [a database called Maude](#), (m-a-u-d-e) where they track accidents on equipment.

So you can look up different types of equipment, laser equipment, different devices and they have accidents in that, but that's supposed to be where if I'm using a laser at a hospital and it fires prematurely or puts out too much energy, I'm supposed to report that to the manufacturer of the equipment and then they're supposed to report that to CDRH, The Food and Drug Administration, those people.

There are a lot of accidents in there, but once again, searching through it's difficult... it's hard to find the information.

So things are happening, but it's, I think a lot of is that people just don't want to, they don't know who to report to or they just afraid.

Tim Bennett: Yes and I understand the fear behind that.

And I've been involved in live events with lasers.

I've never been involved in laboratory or anything like that, the industry has primarily been a self-regulating industry and I think as... when I started in 1989, there was almost zero requirements from a legal side... like "*do not look into laser with remaining eye*" was a t-shirt that we saw quite often.

And it has progressed over the years to what it is now, which I think is very good and I've talked to, obviously [Roberta McHatten](#) about laser safety and [a couple of other people on this channel](#), and I think it's getting better and better, but one of the things I see happening more recently, is lots of lighting professionals coming into lasers and thinking that a laser is the same as a traditional light and using them in the same way and not really fully understanding that there's a difference between the two.

What can be done to actually promote the laser safety side of things to these kind of people?

Ken Barat: Well you know, this is the problem.

This is the benefit and the curse of laser technology.

We went from a time, you know, using... live events, where basically you had a krypton argon laser, you had water cooling, you had you know, cables running

everywhere, and it really took some equipment knowledge and knowledge of physics to set things up properly.

Now we have the solid-state diodes and the whole laser equipment device has become more of a tool, than a physics project, you know.

This is one of the reasons why lasers have become so popular in medicine, you know.

Lasers are used in dentistry now.

So you no longer need a crew of grad students to keep your laser up and running, basically all you do... it's turnkey, you plug it in and it's diode based and the beam is there and it's an issue of, we really have to try to make sure people are aware of, you know, what potential hazard is of the laser beam itself and this somewhat falls to the manufacturer, the sales people and people in the various industries.

I think, we don't want to scare people away from the technology, but we certainly want to make them aware that there are potential hazards, you know.

One of the things that you can use lasers for, is to find latent fingerprints at a crime scene and but this is, a you know, portable unit, you hold the laser hand piece in your hand and you know, you shine it around, well you know, people need to realize that if someone comes into the room or looks like they're going to cross the beam path, you shut it off you know, you just don't wave it around like a wand.

It's kind of like the old cartoons of people giving laser lectures and they're decapitating, you know, the audience.

It's an awareness thing and it's a challenge, because you don't want people to be afraid of the technology, we want them to embrace it, but you still want them

to know when to apply respect and you know, the old saying is, use common sense, which we all know how rare that is.

So, it's a challenge. I think people just need to... I think people... what you're doing... people you talk about things.

You know, one last thing about the illumination... the [first documented pilot illumination](#), was the Southwest Airlines flight over Vegas.

They got hit by a laser beam, from, I think The Luxor Hotel and when you spoke with pilots at the time, you know, sort of in hushed breaths, you'd find out that, that was not the first time someone had been exposed, but they were afraid to mention it, thinking they would lose air time, it would affect their flight hours, they'd be taken off while, you know, they were examined and made sure they were okay.

Almost like the football concussion protocol.

They would be sent away for a while, but now it's become acceptable to report these things and I think that's why the numbers are as large as we have.

People don't feel there's any stigma in reporting it and they don't feel as a consequence that they they're gonna pay for it.

So people are willing to say those things.

Tim Bennett: Yeah and I think that you make some interesting comments in all of that.

Going back to what you were talking about just now, with the dentists and the police using fingerprints, you know, I've never even thought about lasers from that aspect... and I don't know if I've ever heard of a dentist being a laser safety

training program, but that might be something worth investigating.

Yeah and you know from a pilot's point of view, you the last thing you want, when you're about to land a plane with 500 people in the back is a bright light in your face, so yeah definitely a concern.

From your experience and especially relating to live events right now, what would be the most common type of accident?

Ken Barat: Well, I think the most common thing... we run it... well, trying to think of the best example... traditionally people always worry about laser safety when they're trying to align a system, so, but you know actual alignment of the optics and stuff has become less and less with a lot of the commercial systems that are out there now, so I guess what we're most concerned about now is maybe people that have got mirrors or things up on posts or other type of things that are not really secure or they're in an area where someone in the audience can inadvertently strike it and now you have a laser beam going off out of the path that you are required to, you know, that is why you know, one of the regulatory requirements is that during the light show, you're supposed to be able to observe it.

So if anything gets out of sync or out of line, you can shut off that individual beam or the whole show.

So that I say, would be the most common.

The other thing of course, is using laser light shows in the wrong venue.

Just a few years ago, there was a... it was supposed to be an [outdoor rave in Russia](#), it was supposed to be outdoor, weather was such that they moved it all indoors and they had several people exposed to beams that were just going off, because they weren't prepared for that type of operation, so...

Tim Bennett: Yeah and I remember that incident happening and you know, it's a very sad that it happened, because of the bad weather, but it was also because of the, you know, the operators were not ready for that kind of thing.

So would you say that greater training is needed from people generally?

Ken Barat: Oh without a doubt!

I think the more the operators are trained, the safer your shows are going to be and one of the other people that have to be trained or aware, is the owners of the venues.

You know, all the light shows that I ever inspected, particularly in the cases where there was a live audience, the last thing that was ever set up was the laser light show.

You know, stage, lighting, was taken care of all those type of things and the last few moments is when the laser operator got to check out their alignment of the mirrors and everything and of course you didn't want to tip your hand and show your effects to the audience that was filling in, you know, so it was always very difficult and I think management has to understand that they have a certain responsibility to allow people the time to set up properly and safely, because then they can also be held accountable.

Tim Bennett: Yes and you know when I first, very very first started with lasers in 89, I just found a laser. I bought a... actually I bought a bar in England which had a laser in it and I had no idea what a laser was and my DJ introduced it to me and I became a fan, instantly and fell in love with laser.

About two and a half years later, I started working with a laser company based in the UK, in London, a professional laser company and they trained me properly and I thought you know, looking back on that, a lot of these bigger companies, do provide the adequate and proper training for their staff.

I feel where a lot of the danger lies, where it's a smaller one-man band that, you know, they couldn't get a job somewhere else, so they started working with lighting and sound and now they've become involved in lasers as well.

In fact, here in The Philippines, I remember we have a ballroom for one of the hotels, they have three 20-watt lasers inside the ballroom, scanning the audience, the ballroom is only about 25 meters long and I was like *"no please don't do this"* and then when you talk to the hotel management and you get a little pointer, you know, a 2 watt pointer and you point it at a piece of paper and show them, you can set fire to it, they actually go *"oh my God and I've got 20 watt lasers..."*

So I think this is an interesting thing that you make, is not just the operators, but the venues also need to have a knowledge of laser use.

Ken Barat: Yeah without a doubt and particularly I found in hotel ballrooms, at least, you know, for the longest time the favorite architecture was mirrors everywhere, mirrors and hanging chandeliers and all these are great reflective sources for your lasers.

So you know, great care in setting them up becomes critical.

I don't know how appropriate this story is and you can edit it out, but I took of bars, I was aware of a situation where they had an exotic dancer and her gimmick was that her husband, would highlight her body with the laser as she danced on stage and I... one of the already... it happened in the U.S State and once the the State Regulatory Agency found out about this, you know, they definitely had to go down and do an inspection, but it turned out that only the upper management felt they were qualified to evaluate this in a proper way.

So they all go down to, you know, to see this and the in typical fashion, the next day, there's a picture in the local paper of this strip joint and in front of it are all these state-owned vehicles, because they know they were not going to drive their own cars, because they're government.

So you have this... rows and rows of state vehicles, you know, parked in front of, you know, Joe's Strip House or whatever...

That setback laser safety inspections for quite a while in that particular state, so!

Tim Bennett: That's quite funny and hopefully, they're not doing that show anymore!

Now how does your book relate to all of this?

What information do you share in the book that that helps with all of this?

Ken Barat: Well basically, it's... for a number of years... I've done laser safety training for a number of professional societies, for a lot of years and what I noticed was, that you took a training course, you learned a little... you got, gory stories of accidents and gory pictures to look at, that are saying... here an accident happened here, an accident happened there, another accident there, and then it would say, you know, here are the most common reasons for accidents: a lack of wearing eyewear, failure to align, failure block the beams and all like that, but and that was it, so it's kind of like going to a driver's ed class and only seeing pictures of crashed cars and my feeling was that, we were not really giving people all the information they needed.

So the idea of the book, is to look at things like, okay an accident happens to someone, do they know who to call?

You know I think I've been hit, who do I call about this?

Is there... is the information available to them?

Do they know who to call?

I mean nowadays, you would say, you know, maybe you'd put the information on an app and they could look it up at the company and say, "*oh you think you've been hit?*"

Go to this app and it tells you what steps we want you to follow.

So it was, you know, do they know who to call?

Then it was, if the LSO gets the call, are they prepared?

What have they done?

The plan for responding to an accident.

You know, do they have anyone they can call on for technical expertise?

You know, do you have medical and then again, it's, you know, where would you send someone?

There are a lot of places that, you know, internally they may not have a medical person, so do they know who in the area, might be a retinologist or they want to go exam to.

So the idea was to look at laser accidents and a holistic approach and say what are all the elements that you would have?

So yes, there are stories in the book, but, there are three big accidents described in the book, but it also goes through what caused it, you know, what the underlying factors were, you know, what the corrective actions were, how you should deal with it...

Things of that nature.

Then there are other type of accidents, but we also try to cover a broad range, so there are laser light show accidents that are described, there are industrial accidents, research accidents and then there's the discussion of the near misses.

You know, not so much at the beam went zipping by your ear, but maybe you were in a situation where an accident could have happened... a fiber broke, while nobody was exposed, you still, that's could be a near miss and it... also to spend some time on the issue of why accidents keep happening.

Laser technology is 60 years old now, you know, there are protective measures, control measures, why do we still have accidents and part of the theme on that is the concept of no negative consequences.

So you know, if every time you speeded you got a ticket, you probably would stop speeding.

If every time you jaywalked, and you got hit by a car, it's a good chance that might deter you, but just think about every time people have lifted up their eyewear, or violated some, what they know to be a good safety procedure and nothing happened, well every time nothing happens, that reinforces that practice and you know, the real thing is, the potential injury, is so great, you know, is that little cheating worth the effort?

You know, if you do get hit, you know are you gonna say *"well yes, that was worse, you know, bypassing and lifting my eye wear was worth it,"* but, *"no I lost the partial vision or all my vision"* or things like that.

So the book tries to cover all those issues.

There's two chapters on visual interference and dealing with pilots and those

type of things.

A track... thing about fiber optic communications and incidents that happen with those folks and what you should know about it.

Then we talk about non-beam hazards.

You know, everything from, you know, if you're, if you're electrocuted, your eyewear doesn't do you any good and if you are in live entertainment, you know, there are also issues about working at heights, you know, electrical, water, other hazards that maybe, you may be involved with, mechanical you know, there are things as we get older, we can't do as much and ergonomics you know, you can do something to your back, even in your 20s, that will linger with you for the rest of your life.

So it's talk... try to touch us on all those type of situations and there's a lot... there's a nice section on lessons learned.

So an event that happened and you know, you don't want to keep it a secret to yourself.

You want to evaluate it, write it up and make sure other people don't make the same mistake... and so the book tries to cover all those type of topics and you know, in one... in one place, talks about safety culture.

You know, so many places say safety is job one, until it gets in the way of doing something and it talks about culture, like I said.

Reporting, where we report to, things of that nature, so it tries to cover a very broad spectrum and in a way that I find is not touched on in most laser safety training.

So that was sort of the goal of the book.

Tim Bennett: And that's really fascinating, you know, you mentioned just now, about things that are not reported or they're not really looked at.

I remember being part of a show in 1992, where we had a lot of I-400 argon gas lasers, with the water chillers and tons of cables and stuff and we used to blow cigarette smoke over the beams, so that we could see them and every now and again we'd look over and go "*you know, your hair's on fire?*" and it would be quite amusing at the time, but it wouldn't be amusing if you got that beam, that 35 watt beam straight into the eye, as you say, that would stay with that person for the rest of their life, because of one tiny millisecond of negligence.

So I think this is a great point you make.

Ken Barat: Yeah I mean it doesn't always have to be, you know, your eyes.

Many times I had met many light show operators, who would show me some shirt, would had a hole burned through it, from some previous activity and you know, sort of laugh it off, well, you know, there are materials that if you they catch on fire, you've got to chest of flame, you know, they just burst into flames.

So the fact that you were wearing some... a cotton t-shirt or whatever, you were lucky from the from that perspective.

So yeah, I think we're trying to you know, one of the things we also talked about in the book is mentoring on-the-job training, passing on, hopefully good habits to people and not letting people work on their own until you feel that they're qualified to do that and confident that they're not going to injure you and you know, let's be honest, it's not just a personal injury, that people worry about, it's equipment and this piece of equipment's my livelihood.

If something happens that damaged it makes it unusable, you know, that's the

end.

I was involved in a research situation where somebody with a pair of tweezers or something was trying to put in place a custom grown crystal, with their laser setup and they looked down and there was a little red dot beam on their shirt which wasn't supposed to be there and they were startled and they just kind of, you know, had a jerk reflex and in doing that, what happened was the crystal fell out of the tweezers, hit the optical table cracked and so nothing.

And that was eighty thousand dollars now down the drain, but the three months these guys had waited for this custom crystal to be grown.

So while we're most concerned about personal injury, there's a lot of other things that involve reasons for working in a safe way.

Tim Bennett: Yes and a lawsuit is also something that you probably don't want from an accident for your company and we have been talking mainly right up until now about visible light of course.

Lasers also emit invisible lights or some lasers do, and you know I think from what I'm hearing, I think a lot of of the safety aspect comes in the preparation.

In the setting up of... the initial training and mentoring, as you're talking about, but also the setting up of the equipment and the preparing of the workspace that you're going to be in.

I think is very important.

One of the things I... go ahead... go on

Ken Barat: I was gonna say, you know, one of the things we're talking about is, particularly in a lot of light shows, as you're talking lasers, whether they're visible

or you know really invisible in light shows, but you're at power levels that you can do surgery with...

I mean these are casual beams, this is not like some low power laser or, you know, you go to the store and you scan your groceries.

You know, we're not talking about that type of laser system, we are talking about things that can really do physical damage.

Tim Bennett: Absolutely, and going back to the old days when we first started in the the late 80's, if you could have one laser on your show, it was like "WOW" because lasers were so expensive.

Now, I think the world record is 300 and something lasers in one show and they're fairly high powered lasers.

So yeah absolutely!

What you're talking about, is a lot of energy being focused and concentrated in one small area and potentially has the ability to be very hazardous.

One of the things I did see in one of the comments, that I saw in the [Amazon page about your book](#), was talking about the use of virtual reality to help prevent accidents.

How does that tie in?

Ken Barat: Well, I think, you know, if you look at typical training, it's either a classroom demonstration, classroom training or it's web-based and I... but the technology is today, where you could have, you know, VR and you could go through the alignment of a system and working with it, you know, this, I look at VR as like the flight simulator for airlines.

With the advent of the flight simulators people don't, you know, think about this, but actually airline crashes went down more than 90 percent, as pilots became trained in flight simulators, because they could go through a negative scenario without any real consequence.

I mean, if you crash in the flight simulator, all right, you press the button, you start again and I think VR is the same type of way.

I run into a few institutions that are trying to give their people some real experience and real sense of how things operate and stray reflections, through that type of technology, where they can make mistakes and not damage equipment, not hurt themselves or anyone else and it's also something where, you know there are people of mine, you know, my age, who you know, VR is still a wild type of thing, where, you know, there are folks who now, you know VR is, there's nothing it's just a, you know, it's common.

So you've got an acceptance of the technology and a readiness to take advantage of it, so I think over time, I think those people that really thinking about cutting edge and most effective approaches are going to start putting VR into their training and I think they're going to get a lot of benefit out of it and the same way goes... and cost is going down, so it's not the major financial impact that it was at one time.

Tim Bennett: What an interesting concept.

Repetition makes permanent, so if you can get to repeat something on a regular basis in a non-threatening situation, like virtual reality, when you actually come to the situation yourself, you're fully prepared for it.

It actually reminds me of when I was learning to go diving.

I spent a lot of my training in a swimming pool and my coach at the time, kept taking my mouthpiece out and you know, getting me to retrieve it and put it back

in again, for the 200th time.

I thought *"how many times are we going to do this?"*

"I've done it 200 times?" and then one day I was diving in a Japanese wreck, I was in the propeller shaft and my mouthpiece came out and I was very calmly able to retrieve it and put it back in again and that only happened because I'd done it 200 times.

Ken Barat: Right.

Tim Bennett: So this is an excellent idea and I'd never ever thought about using virtual reality to actually do laser training in any way.

So that this is a very interesting concept.

So I guess at the end of all of this, you would like people to buy your book, yes?

Ken Barat: I think it makes a good read...

Yes!

Yeah!

Tim Bennett: Great and I will definitely put a link beneath this video to [the book on Amazon](#) and I know you have some other books as well, about lasers that you've done, so you know you're a well-established author.

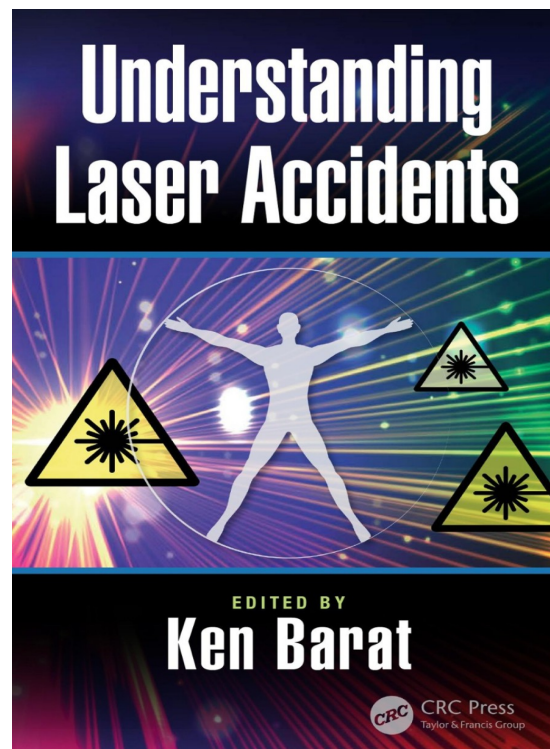
You come with loads of credibility, so thank you for, you know, sharing your knowledge with us and your thoughts with us.

In a moment we're gonna come back and we'll let people know how they get in touch with you, but I'm here talking to Ken Barat about his book... "Understanding Laser Accidents."

Don't go away, we'll be back in just a moment.

Understanding Laser Accidents

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Tim Bennett: So welcome back.

This is Tim Bennett, I am from ArgonTV, I have been joined by Ken Barat, we've been talking about his book "*Understanding Laser Accidents*" and I hope you got a general idea of what causes accidents with lasers and what you can do to prevent it, but we definitely recommend you buy the book and if people want to get in touch with you Ken, what's the best way for them to do that?

Ken Barat: Well, my email address is lasersafetyolutions@gmail.com

That's really the best way you can do.

I'm [also on LinkedIn](#), but the best thing is just to email me and you know, I would say as a throwback, to when I worked for government national laboratories, you know, we were taxpayer supported and so from my perspective, any advice I can give to anybody through email, is really is free.

It's not like calling your lawyer and the clock starts uh ticking away.

So if people have questions that I can answer for them, I'm more than happy to respond to those, but that email address is really about the best thing.

I would say that's the the best...

I do have a website, lasersafetyolutions.org but really email is the is the best best approach and like I said, I'm more than happy to do that, because I think laser safety is something that I feel passionate about and you know, we're here to help.

I think the more people are aware of laser safety, the safer we're all going to be and you know, I gotta protect myself also.

I wanna... I don't wanna get hurt so...

Well that's really about it.

Tim Bennett: Yeah and that's fantastic, I'll put a link to your email beneath this video, I'll put a link to [your website](#), obviously [a link to the book](#) and you know a couple of final thoughts from myself as a laser operator, when we first started, we were always putting lasers into the audience and I started off with a 500 milliwatt argon ALC laser, I had no concept of laser safety, you know, no one really in those days had any serious understanding of laser safety from a show side.

It came... it started to come into my arena early 90s, as I got more and more professional, but you know, the last thing I want to do, even as an operator, is when I go to a venue, is to stand there going like this, because all the lights and lasers are full on in my face.

Especially the lasers.

So you know, over time, I found that for me, the nicest shows are the ones that are actually overhead as they should be, and not fully in my face, so that I have to squint all the time.

So as you know as I matured in the industry and as I became aware of laser safety and the requirements, I think our shows became better and of course, they became safer, which is what everyone wants in the end.

We all want to go to a show and have a great time and hopefully shows will all begin again soon, so we can start getting back to work and it's been a very stressful time, but I must... I must say Ken, you were talking about your email just now, when we first connected, you're very approachable, very amenable and also funny.

So you know people, I can vouch for the fact that, when people email you, they will get a response from you.

Ken Barat: Yeah...

I think I would just like to say that you know, if you think back the laser was invented in 1960.

Our first ruby rod laser, but four years later, we had our first documented accident and now we're 60 years into the laser and it would be nice to be able to say and accidents have stopped, but unfortunately, they're still going on and lasers are just getting into more and more areas and we just like to make sure that people who are using lasers, appreciate their responsibility to keep those around them safe.

So that's really what we want for laser safety.

Tim Bennett: Excellent and thank you for being Ken... being here Ken, I really appreciate you spending the time and sharing your knowledge and hopefully with the sharing of your knowledge and with the books that you have and all the stuff that you put out there, people can be more understanding of the requirements and this is not, you know, we're not trying to stop lasers in any way, we're trying to make lasers safer.

So when they're safer, they're more fun, people have a better time, we all make more money and we all have a great time.

So I want to thank you for being part of ArgonTV and spending your time with us here today.

Ken Barat: Thank you. My pleasure.

Tim Bennett: And I'll put all the links to Ken's contact details in the description.

Please [get a copy of his book](#) and have a read of it and if you need any more additional information, Ken is always around for you to help.

So we have been here with another thrilling episode of ArgonTV, talking to Ken Barat about **"Understanding Laser Accidents."**

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