

# An interview with David Malin

by Zac Pujic

In the twenty years that he has been working as photographic scientist at the Anglo-Australian Observatory, David Malin has managed to become almost as well-known and as successful as the observatory where he has produced some of the world's most beautiful astrophotographs. In early July of 1994, he visited Brisbane, and I took the opportunity to talk with him.

**Zac** - What events led to you to secure a position at the Anglo-Australian Observatory?

**David** - I had been working for a large international chemical company for eighteen years or so in the north of England using microscopes to sort out problems in chemical research. I enjoyed that very much. It was a great challenge. A key ingredient was to use photography as a channel to transmit scientific ideas to people. Even management could understand data shown by photomicrographs!

Eventually I had a small department of two or three people and we were expanding quickly into X-ray diffraction, electron microscopy and so on. It was getting big and I thought I deserved to have Head of Lab status which basically meant more money. But the Director of Research didn't agree, which was a bit of a shock because I thought it was a reasonable request. So at that point, I started looking for something different to do. Finally, this job in Australia turned up in the back pages of *Nature*. It looked different and I thought it was a challenge and so I applied for it.

I got to the first interview which was held in the UK and I thought I'd flunked it. It was awful because I didn't know anything about astronomy. The members of the panel asked a lot of pointed questions which I simply couldn't answer. This was in about September 1974 and I didn't hear anything until February or March in 1975. I was surprised to get a telex from the Director of the Observatory, Joe Wampler, who was at Jodrell Bank and said he'd like to see me about the job.

Joe and I got on quite well but again, I heard nothing at all until June when I got another telex asking me if I could be in Australia by the first of August. Then I started to think seriously about what astronomical photography was about and it went from there. The interesting thing was that I arrived in a place where everyone was very busy setting up the Observatory and no-one had much time to discuss my problems, so I was working in a vacuum for a while. The key ingredient in sorting myself out was to see Bill Miller who at that time was the doyen of astronomical



Large spiral southern galaxy NGC 6744. Photo by David Malin using the 3.9m AAT.

photographers at the Mt Wilson and Palomar Observatories in Pasadena. I spent five days with Bill and that gave me the perspective I needed - and I've gone on from there.

**Zac** - Did you have a family at the time?

**David** - Yes, we had three young children. My wife is Australian. We met and married in England and had no intention of coming to live in Australia. My wife loved England and misses our little country cottage in Cheshire a lot. We had a boy of nearly four and twin girls of two when we left. In fact my daughters celebrated their 21st birthdays recently. They've grown up here so they're essentially Australian. And I'm Australian too.

I was citizenised many years ago since I like being here and it was clear I was going to stay. My life has changed very much because previously it was a 9 to 5 job five days a week. When you drove out the company gates that was it. You forgot about it until the next day. It's not like that now. Now it's a full time occupation. In a sense, it's a public service job with a small group of people who are all highly motivated. Previously it was a private industry job at a site where there were several hundred graduates, not all of whom were highly motivated. And it was a commercial enterprise. So everything changed including the scale, from microscopy to telescopic. From private to public and big to small. It

was a big change and it took a lot of getting used to because in my previous existence, if you wanted to buy something, you just phoned the right department and just said please get me one and it would just turn up. Here, you have to get the tenders for it, sign everything, chase the supplier and do everything yourself because we're too small to maintain support of that kind.

**Zac** - Did you have any interest in astronomy before you took up your work at the AAO?

**David** - Yes I was always interested in astronomy but not strongly enough to buy a telescope for instance. I was always fascinated by the Moon and by the solar system, and I knew a bit about stars, but it wasn't a strong motivating force. I had taken some star-trail pictures - that kind of interest. Not disinterest but not very strong either. But when I arrived at the AAO, I realised I'd moved into an environment where people were totally absorbed with what they did. It was part of their being and that rubbed off very quickly. They were young and enthusiastic and fairly early on, I started to make some major improvements in the photographic process as applied to astronomy and these people were really enthusiastic about it. I remember showing Paul Murdin one of the first colour pictures I ever made in the mid 70's and he was overjoyed.

He said this will make your reputation. I had no idea it was true but it was. That kind of encouragement makes you work hard. It's a very good environment for me to be in because I like to tinker and try new things. A research environment lets me do exactly that.

**Zac** - It's quite a niche too since there aren't many other professional astrophotographers, and so that's one reason why you have become so successful. You don't have much competition.

**David** - That's absolutely right. When I started, there were half a dozen around the world but now I think I'm the only one. They've all either retired or have done something else. Mainly they've been displaced by electronic detectors - CCD's for example. I still believe that photography has something to offer. It's very much a personal thing. I suppose if I was to fall under a bus tomorrow, photography would likely die at the AAT, although the UK Schmidt would continue because it is a photographic telescope. The link between the AAT and the UK Schmidt is a very important one and I've always been able to get photographic plates of objects in the sky taken by the Schmidt. I should correct a misconception here too. In some of the literature about what I do, it says that I take photographs with the UK Schmidt. That's not true. The UK Schmidt has a small crew that takes plates on request, but I don't do that personally.

**Zac** - Many people have the misconception that you can go to the AAT and take photographs of what you want and when you want. That's not true is it?

**David** - Ha! Getting time on the AAT is very difficult. You have to write a detailed description of what it is that you intend to do, and why, what the scientific results will be, list the objects and exposure times and calculate how much telescope time is required and so on. This detailed proposal then goes to a committee of astronomers that meets every six months. They assess all the applications for telescope time for the next six months. During the two-day meeting, the panel decides which proposal can have time and which can't. That decision is made on scientific merit only, not on big names or whether you work for the AAO. In fact working at the AAO does not give you any advantage. If it's a good scientific proposal, the chances are it will get considered for time. But even the alpha-plus proposals far outnumber the number of nights available.

In the end, the committee encourages collaborations between groups who have the same interests. And it almost always awards fewer nights than you ask for so you have to make the very best use of it. So when it's your turn, you spend a lot of time working out what you want to photograph, making sure that you

start the night with red plates in twilight, for instance, because the twilight sky is blue, and exposures can be started ten minutes earlier than other colours. The whole night is worked out in considerable detail, down to within a few minutes or so. That's fine if everything goes smoothly, and it rarely does.

You may get cloud, something may break down or you may not find a guide star quickly enough. So you always have to be prepared to compromise and to slip in a new object for which you already have some plates. And then there's the business of hypersensitising the plates. That takes two or three days beforehand. So a lot of work goes into a night on the AAT. You don't just turn up at the AAT, point it somewhere and trip the shutter. It's not that simple.

At the end of the night, you may have a dozen plates or so and then the real work starts in making sense of all this. That's the exciting, challenging bit. I enjoy observing, but extracting information from the plates at the end is really what satisfies me.

I get between 5 and 8 nights a year. Of those, one or two will be cloudy, and another might be affected by other conditions. I'm on the mountain about one week in every six or eight. I need about 4 days on the mountain for one night's observing, so it's nice to get two nights in a row because you can prepare all the plates for that run. It's very unusual these days to get four nights in a row. I used to years ago when a lot more photography was done. And that's very taxing. Four nights in the winter is very hard work.

**Zac** - Are you given nights which tend to encroach upon full moon more often?

**David** - No, I normally ask for and get 'dark' time. Telescope time is divided up into bright-time and dark-time. Often you get a 'dark' night with a quarter moon; though it

doesn't last long it is a problem because you can't go deep with the moon in the sky, so you have to choose objects which can tolerate a bit of moonlight.

**Zac** - Will it ever be possible to adapt the AAT for adaptive optics?

**David** - A full adaptive optics setup for all focal stations of the AAT is not likely, but we are looking at such systems for some instruments, typically those that have small entrance windows, and those that work in the infrared. (*Editor's note: A collaboration between Sydney University, the AAO, and other universities is currently installing an Adaptive Optics system at the Coude focus for use in particular with IRIS. It appears likely that a tip-tilt system for the secondary mirror (to serve all focal stations except prime) will be a priority within the next 5 years.*)

**Zac** - What is the function of the corrector which extends the usable field of AAO from 1 to 2 degrees?

**David** - The corrector was not designed to be a photographic device. It has been used for photography, mainly for commissioning purposes, and we showed that those photographs are actually very useful for finding objects, but at the moment there are no long-term plans to use the two-degree field system for photography. Partly because you can't photograph the entire field - the plates would have to be twenty inches square. Twenty inch square plates are available, but we would have to redesign and rebuild our darkrooms. Its function is to image a field which can be sampled with 400 optical fibres which feed a pair of spectrographs to give hundreds of spectra in a single exposure.

**Zac** - Kodak has discontinued the production of some emulsions. How does this affect your work?

**David** - It has seriously affected the col-

*David Malin signing a copy of his book, A View of the Universe, for Kevin Dixon (left) and Peter Adam (right), members of the Southern Astronomical Society. Photo by Zac Pujic.*





*Jupiter taken at the Coude focus of the AAT. One of the first images taken by David. AATB.*

our photography program. Most of the photographs I've made over the years have been made on emulsions that were introduced in the 1930s and 1940s. They've been upgraded a lot since then but basically they're old-fashioned emulsions - IIaO, IIaD and 098-04. If we're going to continue doing photography on plates, we're going to have to use the IIIa emulsions which are fine, but they're much slower - slower by a factor of three. So I'd feel rather guilty about using great slabs of telescope time although I will certainly use some. There are some objects that are so faint that they need these fine-grained emulsions, but they are very difficult to handle because the contrast is so high and hard to control.

We use the Technical Pan 4415 (2415 on a thicker base) in the Schmidt. It's very nice stuff and is better suited for the Schmidt than for the AAT because its resolution is wonderful. We came to realise that we had actually been undersampling on the UK Schmidt. The image quality of the Schmidt is such that it really wasn't exploited with the IIIaJ emulsions. So with Tech Pan we get better image qualities.

**Zac** - About five years ago, the Hale Reflector took its last emulsion photograph. When will that happen with the AAT?

**David** - I think that was an unnecessary amount of fanfare and premature. There's no sign of it happening at the AAT. As long as we can get plates, or even film, we'll continue to take photographs. I think declaring photography dead like that is a peculiar thing to do because it still has some unique characteristics that nothing else can match, not even CCDs. I don't see CCDs and photography as being in competition. There certainly are areas where CCDs have taken over the role of photography, and that's quite right too because

they have properties which make them uniquely useful in astronomy, but there are also some things that photographic materials can do that CCDs can't, especially when it comes to large area imaging. So the two techniques are complementary. If you want to have a linear detector that can directly address a computer and has a wide dynamic range and has very high sensitivity, you'd use a CCD. But if you want a detector that covers a wide angular field where the resolution is much better than you get with a CCD, and you do not need the best quantitative information, then you would use a photographic plate.

**Zac** - So would you say that a CCD gives high image quality while an emulsion gives high image quantity?

**David** - No I wouldn't put it like that. In fact I don't think that's true. Image quality, photographic quality, comes from having lots of small pixels. When you look at a photograph, it has a uniform quality or smoothness which you would describe as a photographic quality. CCD's aren't yet able to reproduce that photographic quality because their pixels are too few and too big. Don't abandon photography for God's sake!

**Zac** - What's the first astronomical photograph you took with the AAT?

**David** - It was Jupiter, although it was not photographed with the prime focus camera. It was a light-hearted thing to do in twilight. We went down to the coudé focus and stuck a Pentax camera on a tripod there. I unscrewed the lens and the image of Jupiter was just focused on the film. But unfortunately, with a focal length of 140 meters, the image of Jupiter was too big to fit onto the 35 mm film. The next night I turned up with a Hasselblad and just put that in the beam. I think the image of Jupiter at the coudé focus is about 40

mm in diameter, depending on its distance, but it's pretty big. So you need special gear even to photograph the nearby planets.

The image quality was brilliant. It was about the time that NASA started to launch their spacecraft and they were able to produce much better images than you could get from the ground, although I have to say I was very disappointed to see the way they've colourised them. People are disappointed now when they look through telescopes at Jupiter and say "where are the colours?". There's a touch of Hollywood about NASA I find disconcerting and it appears also to some extent in the Space Telescope images. They use false colour in a way that I think is misleading. It over-dramatises the rather subtle colours of Nature. It's a worry. This is scientific data and you have to be really careful how you present it. Much of my life has been oriented around presenting scientific data in a way that doesn't distort it and to see the way this happens is really bothering.

**Zac** - Do you have your own telescope?

**David** - No. I have a pair of binoculars which give me great pleasure but no telescope. The first telescope I ever used was the AAT and I guess everything's downhill after that. I've looked through it and I use a little magnifying glass I carry around in my pocket as an eyepiece. In fact it's a magnifier I use for inspecting photographic plates when they come out of the fixer. There is a proper eyepiece in all truth but it's a big bulky thing and it's awkward to use. It's got a swing out arm to reach the focal plane and more often than not it's too inconvenient.

**Zac** - What have you looked at?

**David** - All sorts of things. I like looking at galaxies for instance, trying to see the spiral structure which is often very difficult. I think the most exciting thing I've looked at is Eta Carinae. We had a night of very good seeing on the AAT when I happened to be taking photographs at the f/8 focus, which is very unusual. The image scale there is about six arcseconds per millimetre and I had a long look at the Homunculus nebula. It was a most amazing sight. And then one night I had a look at the Orion Nebula at prime focus. Something had broken on the telescope and it just happened to be tracking in that direction and so I looked at it for a while. I enjoyed that a lot. By and large, I might get to see an object I intend to photograph for thirty seconds or so, often just to confirm that it's there or just for interest. So although it's essentially true that astronomers don't use telescopes visually, if you've got a focal plane in front of your eyes, you're always inclined to have a look at it.

**Zac** - What's the annual funding of the AAO?

**David** - It's about 6 million Australian

dollars, and that comes jointly and equally from the British and Australian governments. For that money, Australians and the British get equal observing time on the AAT and the UK Schmidt, which we also run. The AAO has about 65 people, roughly half are in Sydney in Epping and the rest are in Coonabarabran. In Sydney we have the laboratories and workshops, main libraries. On the mountain, we employ a large number of highly experienced technicians to keep the whole system working, plus some astronomers at the Schmidt.

**Zac** - How does the productivity of the AAO compare to other major observatories?

**David** - It's pretty good. If you look at the other major institutions in the USA or South America we stack up very well indeed. Of course, none of them are strictly comparable for all sorts of reasons, but if you make a few allowances, you'll realise that the AAT is a very tight ship indeed. The Brits and the Aussies get excellent value for their money, though it is very difficult to assess scientific output in purely dollar terms. However, in terms of scientific and technical innovation, scientific productivity and all-round efficiency we do very well indeed. People from other major institutions come to look at us because they wonder how we do it for the money.

**Zac** - How much of your present time is spent photographing, and how much is spent doing administrative work?

**David** - It's a great regret to me that whereas once I used to spend half my time in the darkroom I now spend half a day a week, if I'm lucky. That's of enormous concern and its going to get worse because I'm taking on more and more administrative work. I'm also travelling overseas quite a lot more giving invited talks. I'll have to stop doing that so much.

I enjoy it but it's very wasteful in terms of time. It takes you weeks to prepare the material before you go and then you're away for three or four weeks, and then you come back to a pile of stuff that's accumulated while you've been away. So a four week trip will actually take two months out of your life and that's too expensive, so I'm going to cut down on the amount of overseas travelling I do.

**Zac** - Can you tell the readers about your books?

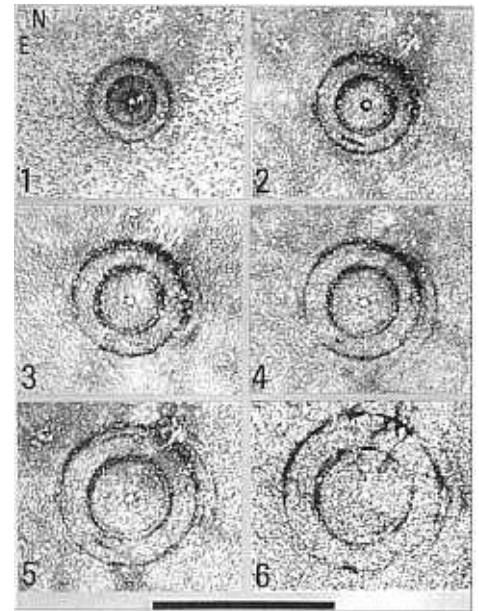
**David** - One of the major turning points of my life was when Paul Murdin and David Allen asked me to collaborate with them in producing the book called *Catalogue of the Universe*. This was very early on-1976-when we started doing this. That really introduced me to the wonderfully rich literature of astronomy, especially the historical literature because I was searching for pictures of this or that to illustrate our book, and that I thor-

oughly enjoyed. It also introduced me to the broad astronomical picture. I mean if you collaborated in book called *Catalogue of the Universe*, you're assumed to know a bit about objects in the catalogue! And so I learnt about symbiotic stars, Cepheid variable stars, star forming regions and Bok globules, Seyfert galaxies and quasars. I got a wonderful educational overview of what optical astronomy was about, so that book was extremely useful. It sold well and it sold out quite early on.

In 1984, Paul Murdin and I produced *Colours of the Stars* which is a book I'm very fond of because it's got a historical feel to it. I love the history of astronomy. I think explaining the history gives a very good basis for understanding what goes on in modern astronomy. I wrote a lot of the book, and illustrated it, of course, but Paul polished it in a way which I think is really splendid. More recently, I've just published a book under my own name, *A View of the Universe*, and that's gone extremely well also. Cambridge University Press tell me it's nearly sold out after nine months which I think is excellent, so there will be a reprint of that.

I've just finished working on a revision of a well-loved Australian book called *Objects for Southern Telescopes* by E.J. Hartung. This was produced in 1968 and was aimed at the serious amateur observer. Basically it's a list of interesting objects visible from the southern hemisphere. I've been working on this with a Sydney amateur, David Frew, who also writes very well and is a great enthusiast. David's worked very hard indeed in updating the core of this book which is the list of about 1100 objects including many double stars. As you are aware, double stars have orbits that precess, and spacings which change.

One of Malin's "signature" images. *Eta Carinae* taken with the 3.9m AAT. AATB.



Series of pictures of light echos from SN 1987A made with photographic plates taken with the 3.9m AAT. The images were made by subtracting recent photographs from a negative taken in 1984, before the supernova. Most of the information common to both series of plates cancels, leaving the light echo revealed as two distinct rings. The scale bar on the print is 5 arcmin long. All the plates were taken in green light and show the light echo on the following dates: 1. 15 July 1988; 2. 6 Feb 1989; 3. 25 Aug 1989; 4. 21 Nov 1989; 5. 14 Dec 1989; 6. 3 Feb 1992.

AATB.

A lot more information is available on double stars now than was available in 1968 when Hartung put his book together, and so David has done a huge job of revising the major tables in the book. He's also written a chapter on amateur observing, basically updating Hartung's chapter, and I've written the expanded introductory chapters. We've also illustrated it so it will have almost a picture a page of the kind of astronomical objects Hartung was keen on, and there's colour in it for the first time. That should be out in 1995.

There's another book I'm working with some colleagues from the CSIRO Radiophysics Division on the history of Australian astronomy. It started off as a popular book but since then, it's grown into a major text which we hope will be popular. It's written in a popular easy-going way, but it's a much bigger book than I expected. That is now also in press and should appear in 1995. But I'm not the lead author on that and my role in it is quite small. I'm basically responsible for three or four chapters and illustrating the whole thing.

**Zac** - Have you any major projects?

**David** - The last three years have been extremely busy. As I say, I've produced three books and lot's of other things as well, and I'm going to take it a bit easier and spend more time with my family, largely because



The distinctive 'elephant trunk' dust lanes in M16, the Eagle nebula, are elongated by the action of stellar winds from the massive stars in NGC 6611. A few dark Bok globules are scattered across the face of the nebula. AATB. Caption from *A View of the Universe*.

we've bought a new house which I want to work on. I want to spend some time playing around with it. But there is a big project bubbling along in the background and that is a major catalogue of faint features in bright galaxies which I'm working on with Brian Hadley who is a photographic expert at the Royal Observatory at Edinburgh. In fact I spent two months at Edinburgh last year working on plates from the UK Schmidt, copying them and adding the images together to reveal the very faintest things. And we've turned up some really interesting and unexpected features of bright galaxies. Basically, this catalogue will be a probe of dark matter and the interesting business of galaxy mergers. I've got a lot of work to do on that. The photographs are done and now I've got to get into the literature and find out what's known about perhaps 200 galaxies in some detail and that's quite a big job.

**Zac** - What's the future of your work at the AAO?

**David** - Well, I think more of the same, but it never is the same. Every time you turn around, there's something new and interesting to do. The photography isn't a problem. There are so many things I want to do stashed away on the shelves that it's difficult to know where to turn next, and invariably when you start one project, something more interesting comes along and then you get the two of them going and that's how life is. It's very, very full. And there is the PR side, of course, that keeps me quite busy, giving talks, interviews and dealing with the day-to-day queries that the photographs generate.

**Zac** - You said that if you were ever run

over by a bus, photography at the AAO would probably stop. Is there anyone in the ranks who would continue your work if you stopped?

**David** - Not exactly in the ranks, but Steven Lee who is a night assistant at the telescope and a good friend as well always helps me with photography, and Steven knows how to do it, so it wouldn't die if I did. Steven would continue it. But it does need someone to be in there pushing it. You have to wave the flag for it and make sure that people know that photography is alive and well. If someone is talking about a project, you have to be alive and alert to the things it can do so you can say, yes we can do this or that photographically. Steven's main astronomical interests lie elsewhere, but we have worked together for many years at the AAT's prime focus so there is no doubt that he knows how to get the best photographic images out of the instrument. So the technical know-how wouldn't die. That would survive.

**Zac** - What in your mind are some of the greatest discoveries that you've made. Not necessarily technically the most interesting, but the ones that stick out in your mind?

**David** - Well they fall into two camps. The nicest scientific discoveries, and basically I'm a scientist, were the shells around elliptical galaxies which I discovered photographically about a decade ago. And that was very timely because that discovery coincided very beautifully with some theoretical work which was being done by Peter Quinn at Mt Stromlo who was doing his PhD. He postulated the existence of such shells at the time I discovered them. And that was really very satisfying.

The existence of those shells has changed the direction of research on elliptical galaxies. The second happy find was the discovery of Malin 1 which is a big, extremely faint galaxy behind the Virgo cluster which is in the northern hemisphere. People had been poking around in Virgo for a long time looking for interesting things and it was good to find something new there from the south using the UK Schmidt. But the other side of my activities are my colour photographs. It's becoming increasingly clear that there's good science to be obtained by looking at them and trying to interpret the colours that are there. And I also find that very satisfying. That takes me into the realm of producing pictures which are aesthetically pleasing in their own right rather than as being scientific images and I get a lot of pleasure when people come along and look at a photograph and they admire it for its aesthetic qualities. This in a sense covers science and art and is a bridging activity which gives me a good deal of satisfaction.

**Zac** - You managed to get into astronomy by the back door. Many people are trying to

get into astronomy by the front door. What advice can you give to young astronomy students about how to do astronomy well?

**David** - I think the first thing you have to do is to get a good physics degree. Physics and maths, especially physics. That is a very important ingredient. Then do an astronomy PhD. That won't guarantee you a job as an astronomer, but it'll put you in the front line. The fact is that there are many more people who want to do astronomy than there are jobs available, because as you say, it's an attractive, exciting, stimulating and interesting thing to do. But you have to accept that not everybody who gets a PhD in astronomy goes on to do research in astronomy.

I did get in through the back door and I've been extremely lucky. I do know that, but I'm pretty sure it could only have happened in Australia. I can't imagine my career taking off in the way it did anywhere else because this is a land of opportunity and the observatory is a small group. Given both those ingredients, any effort you put in shows, and if you don't put any effort in, that shows too. But if you're successful, that's recognised straight away, and success breeds success. It gives you confidence to do other things and so you take on more and more complex things.

I've never had any photographic or astronomical training, but once you find that you can produce useful astronomical data, and then help in interpreting it, that gives you a lot of confidence to go and search out things on which you know you can provide some useful information. Initially you stumble over things serendipitously but quite quickly you learn to look for objects where you know there's going to be something interesting. That's what I did with the shells and Malin 1.

**Zac** - Do you find astronomy relaxing, and what do you do when not doing astronomy?

**David** - Doing astronomy in a professional sense isn't often relaxing. There's a lot of pressure, which might be hard to appreciate. There's always many more things to do than there is time available, so you take a lot of work home, and you work nights and weekends, and then if you try and produce books as well, that completely fills your day and night. But recently, I've relaxed by playing with my computer as many other astronomy people do. I've had all of my images digitised and I'm fiddling around with them with Photoshop on my Mac and having a wonderful time, realising what a powerful thing image processing is. And then I enjoy the beach and the ocean. We live in Sydney on the north shore and the sea is wonderful, warm and lovely. And we've just bought a new house and so I'm going to take some time off work and do things to it. I've always enjoyed restoring houses, and I relish my family life. ■