

PANORAMA

The Journal of the International Association of Panoramic Photographers

Autumn/Winter 2009

Volume 26, No. 2



Publications by Members

Congratulations to IAPP Life Member Michel Dusariez for being featured in the September 15-21, 2009 issue of "La Tribune de Bruxelles" (www.tribunedebuxelles.be). Mr. Dusariez's work was discussed on pages 3 and 6, and reproductions of his panoramas were featured at the top of 14 pages in the 24-page publication.



ÉDITION SPÉCIALE ! BRUXELLES À +360°

Dans ce numéro : des rendez-vous Patrimoine, le programme de Bruxelles-Champêtre et la Journée sans voiture. Et gagnez des voyages pour LONDRES !



Les œuvres d'art
sont un patrimoine
commun,
Dexia ouvre ses
collections

19 et 20 septembre 2009

Voir en page 13

Photos de Michel Dusariez

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On the Cover

"The Wave", a sandstone formation in the Paria
Wilderness, Arizona. By Scott Highton.
(please note that this image has been modified from the
original in order to fit within the dimensions of the
cover page layout. Please visit www.vrphotography.com
to see this and an assortment of other works by Scott.)

Background Image on this page

Liftoff of balloon at the Albuquerque International
Balloon Fiesta. By Richard Schneider.

Volume 26, Number 2

David Orbock
D. John McCarthy
Richard Schneider
Brian Akerson
Tom Curley
Christian Fleury
George Pearl

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Director
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Director
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submission guidelines, please visit our web site at
www.panoramicassociation.org/panorama.php

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for correspondence only. All articles and
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For advertising and other forms of corporate support
to IAPP, please contact the Panorama Editor.

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in the State of Florida. IAPP is an affiliate of the
Professional Photographers of America (PPA).

Message from the President

*By Dave Orbock
Baltimore, Maryland USA*

Although I have only been President for a few short months, I have been a member (Charter) of IAPP since our first meeting in Hampton, Virginia in 1984. Additionally, I am the only member who has attended all of the International Conventions. During this time I have seen the ups and downs of the organization and witnessed infighting on several occasions. Hopefully, we have resolved most, if not all, of our differences and can work together to enhance both our personal photographic skills and the mission of IAPP.

Our recent Photo Safari to Albuquerque, NM was fantastic. Until you've seen 700 balloons of all shapes and sizes take off over a period of approximately 2 hours, you haven't seen a balloon launch! See our web site for some of the spectacular photographs taken during this event which was held in conjunction with IVRPA. Future events include our International Convention in Tucson, AZ (held again with our good friends from IVRPA) in the middle of April 2010 and an early September 2010 Workshop on Star Island, NH. Both of these events will offer great photo opportunities and technical sessions.

As you know the International Association of Panoramic Photographers is an all volunteer organization which relies on our members for both leadership (your officers and directors) and the sharing of information to accomplish our stated mission of educating and promoting the exchange of artistic and technical information with respect to panoramic photography and immersive imaging. Without your help it will be impossible to achieve our mission.

Election of IAPP Officers and Directors

Right now our board is in the process of securing volunteers to serve as either an Officer (President-elect, Secretary, or Treasurer) or Director. Elections will take place in early 2010. So, if you have a few hours here and there to devote to furthering the mission of IAPP, please step up and call/write George Pearl with the IAPP Nominating Committee at 404-872-2577.

If you prefer not to volunteer for the board - perhaps you have time to lead or work on one of our committees, such as, seeking corporate sponsors or new members. You could even organize a workshop in your area.

State of IAPP Finances

The recession has not only affected our personal finances; it has also affected the finances of IAPP. Our membership is down slightly and we have had problems (now corrected I hope) with our web dues and registration protocols. In some instances we have failed to register new members and add them to our mailing list. Only with active committees and programs, and a good fiscal base will we be able to accomplish IAPP's stated goals. The bottom line is that we need to beat the bushes for sponsors and new members; and we need to keep our present sponsors and members coming back.

Dues Increase

At our December 2nd board meeting, a motion was approved an increase in our dues to \$75/year. However, you can still get the present rate if you renew before January 1, 2010. The Board also voted



to experiment with a downloadable version (.pdf) of Panorama that will be made available before the end of December. This will save the IAPP between two and three thousand dollars per issue in printing and postage costs. Please note that we still intend to publish a hard copy (in B&W or color) when our finances improve.

Goals for IAPP

As a professional photographer who started shooting panoramas in 1978 with a Paskin electrified/Lipari reconditioned #10 Cirkut Camera, I have seen many changes and advancements both in the technology and the artistic development of panoramic photography. Perhaps the most profound change has been the introduction of the digital camera. Digital however, has made many photographers "sloppy" in that they tend to take many images in the hope of getting one (or two) good images. In the "film" days one was more careful to study a scene and select the proper photographic moment. With a Cirkut camera a good day of photographing meant 3 or maybe 4 photographs. Most days I was happy with 1 or 2.

With these thoughts in mind my personal goals for the organization are:

1. To further the technical and aesthetic aspects of panoramic photography through our web, publications, meetings, and exhibitions.
2. Improve the financial state of the organization.
3. Improve the timeliness and content of our web postings.
4. Develop an e-commerce site where our members can sell their images. IAPP will take a commission.
5. Start archiving our member's association with

panoramic photography. We need to do this to preserve the history of our organization and of IAPP's role in the development of panoramic photography. Perhaps I'll live to see IAPP's Museum of Panoramic Photography.

IAPP Board Contacts

It will be difficult to make significant progress in some of these endeavors without our member's efforts. Call or write anyone on IAPP's board and see where you can help.

President:	Dave Orbock	410-528-1868
Treasurer:	D. John McCarthy	413-596-8752
Secretary:	Richard Schneider	410-530-9032
Director:	Christian Fleury	650-269-0212
Director:	George Pearl	404-872-2577
Director:	Brian Akerson	703-330-3269
Director:	Tom Curley	860-355-4701

NEWS RELEASE FOR IAPP MEMBERS: IMAGING USA

Being an affiliate of the Professional Photographers of America (PPA), IAPP takes part in the Imaging USA convention every year. This year's location is in Nashville, Tennessee, to be held January 10 - 12, 2010, at Opryland Hotel.

Imaging USA draws more than 8,000 qualified attendees, professionals from every specialty in photography, including wedding, portrait, school, sports, events, medical, forensic, advertising, and commercial. The IAPP will have an exhibit booth among the some 5 or 600 exhibitors present at the event. Also featured is the world's largest annual print competition of professional photography featuring over 3,600 award-winning images on display. This convention is HUGE!

The IAPP Exhibit Booth will display some of the panoramic images taken by our members and have membership brochures and other information available for the attendees. The booth this year will be manned by our president David Orbock, IAPP Board members George S. Pearl, QPP, and John McCarthy, QPP. Also helping out will be George's wife and IAPP member Claudia.

"We hope to not only sign up a lot of new members for IAPP, but also interest and sign up attendees for our Tucson convention to be held in April." says Pearl. The booth this year will feature a 20 foot long 4 foot high panorama on display.



Albuquerque International Balloon Fiesta, NM. By Dave Orbock.

Messages from the Treasurer

*By D. John McCarthy
Wilbraham, Massachusetts USA*

IAPP Richard Fowler Foundation

One of the founding members of the International Association of Panoramic Photographers was Richard "Dick" Fowler. Dick worked tirelessly for the IAPP for many years in a variety of positions and was the publisher of the original Panorama newsletter in 1984. When he died many of the members wanted to honor his service to IAPP by donating around \$2,500.00 for educational programs in his name.

Several boards and committees tried to figure out the best way to use the money and appointed several committees to deal with the issue. The last board passed a motion to create a 501c3 spin off called the IAPP Richard Fowler Foundation that in the future will finance educational programs.

Finally under the current board the foundation was incorporated as a not for profit in the Commonwealth of Massachusetts and the paper work to create a 501c3 was filled with the IRS and approved. The mission of the new foundation is "to raise funds for the education of photographers about panoramic photography."

The IAPP Richard Fowler Foundation is a corporation with no members and it's current board is comprised of members of the IAPP board. It is patterned after the North American Nature Photographers Association, NANPA Foundation that has done a great job educating young people about nature photography. Every year their foundation brings high school students to the NANPA convention to take dedicated workshops as well as participate in their convention.

Of course \$2,500.00 is a very small endowment and the first objective of the new foundation will be to grow that seed money into an endowment that will be large enough to throw off enough interest income to start funding events. One unique program that will be initiated is the Endowment Charitable CD.

The new Charitable CD is designed specifically for not-for-profit organizations and their supporters. This is an innovative way for you to create an "endowment" fund by allowing the interest earned on your Certificate of Deposit to be donated to the IAPP Richard Fowler Foundation.

Here's how it works: All you have to do is open your Charitable CD at Hampden Bank and tell them

that you would like to donate to the IAPP Richard Fowler Foundation. The monthly interest that you earn on your CD automatically goes directly to the IAPP Richard Fowler Foundation in the form of a donation. You always retain ownership of the principal amount. At maturity, you can renew, donate, or retain the principal - the choice is yours. Donations may be used at the IAPP Richard Fowler Foundation's discretion. You will receive annual statements directly from the IAPP Richard Fowler Foundation for income tax purposes.

Benefits:

- An easy way to support the IAPP Richard Fowler Foundation
- It's automatic
- Only \$100 minimum to open the account
- No monthly or annual fees
- Your choice of maturity dates
- The interest earned may be tax-deductible (see your tax advisor)
- Deposits are FDIC and DIF insured

Contact:

Shana Hendrikse, Branch Manager
Hampden Bank
2005 Boston Road
Wilbraham, MA 01095
413 452 5280 or 413 543 6953

The IAPP Richard Fowler Foundation is a not-for-profit 501(c)3 organization. Your gift is tax-deductible. Our Federal tax ID number is 26-4250451.

Service Award and Degree Programs

The Board of Directors has passed an exciting new service award and Master of Panorama Photography Degree programs. The service award program will reward IAPP members for years of membership, attending conference and conventions, writing articles, and serving on committees and boards. In order to earn the Master of Panorama Photography you have to enter our annual photography contest and earn merits for excellence.

Merits will be awarded annually after members fill out a merit request application and send it to the IAPP secretary. When the member earns enough service or print merits the appropriate degree will be awarded at the awards banquet at the IAPP International Convention.

Because this is the first year of the program members can apply for merits retroactively as long as they did not have a break in membership of over two

years. The merit request form can be downloaded from the web site. The merits will be earned according to this schedule.

IAPP Service Award Program

The service award program is a means to commend members who have freely given of their time and energy serving IAPP, to encourage them to get involved with our "inner workings", and to recognize their photographic talents as follows:

1. The IAPP Master Photographer Degree: Recipients of this degree (Blue ribbon with medallion) must earn 25 merits, be a member of and earn 25 service merits, at least 13 of these merits must be from have prints accepted and or earn special awards in IAPP print competitions.
2. The IAPP Craftsman Degree: Recipients of this degree (Red Ribbon with medallion) must earn 25 merits, 13 of which must be earned for speaking at IAPP sponsored or approved conventions, conferences, and other venues.
3. The IAPP Service Award: Recipients of this degree (white ribbon with medallion) must be a member of IAPP and earn at least 25 merits.

Members who receive multiple awards would get ribbons with the following colors:

- Craftsman Degree/Service Award
- Master Photographer/Service Award
- Craftsman Degree/Master Photographer Degrees
- Craftsman Degree/Service Award/ Master Photographer

IAPP Master Photographer Print Merits

Acceptance in IAPP Print Show:	1 Merit
Special Award: e.g., best of category	2 Merits

IAPP Service Merits

Membership per annum	1 Merit
Work at IAPP booth at PPA or other venue	2 Merits
Sign up new member	1 Merit
Sign up new sponsor	2 Merits
Enter print competition	1 Merit
Convention Attendance	1 Merit
Workshop or Safari Attendance	1 Merit
Program Speaker (1 hour program)	2 Merits
One Day Workshop Speaker	3 Merits
On line course (More than one week)	5 Merits

Panorama/ePanorama Articles	2 Merits
Panorama Editor	3 Merits
Web Master	3 Merits
Panorama Editor	3 Merits

Board Membership	3 Merits/per term
Committee Membership (Non Board)	1 Merit/per term
Committee/Conference Chair (Non Board)	2 Merits/per term
Board Officer in addition to serving on board	1 Merits/per term
President in addition to serving on board	1 Merit/per term

The service award merit applications will be available to members in January and should be filled out and returned to the IAPP secretary at least 30 days before the convention if you have earned enough merits to receive an award.



Fall Colors near Jemez Springs, NM. By Seth Arlow.

Star Island Workshop

*By Peter Randall
Portsmouth, New Hampshire*

Peter Randall is organizing a panorama workshop on Star Island, NH. The island serves as a retreat center most of the summer but is open to other groups in September. The islands (there are more than one) are extremely photogenic (Dave, our president, has 5 large panoramics on display in the main building) and the 3 day event from 9-12 September will pass very quickly. We will need to estimate the number of attendees by early March, so think about it and if you wish to attend contact Peter at peter@perpublisher.com.



The cost for the three night, four day weekend ranges from about \$300 to \$400 with all meals, plus ferry fee and parking. The following link is for last year's weekend. Expect to pay about 5% more for 2010.

<http://www.nhspa.org/si09/PhotoRetreat.shtml> IAPP members will join with the New Hampshire Society of Photographic Artists.

Photographs of Star Island for this article by Peter Randall.



Next Page:

In honor of IAPP's 25th Anniversary in 2009, the Editor decided to reproduce - in its entirety - one of the earliest copies of the IAPP newsletter (in the days before it was called 'Panorama') from November of 1984. Please check what names are familiar and perhaps bring back memories. May IAPP grow and prosper for 25 more!

We just brought in a closeout on 50 packs of the Museo Panoramic Cards.



The only inkjet Fine Art Panoramic Cards. Folded they measure 3 7/8" x 9 1/8".

**EXCLUSIVE IAPP OFFER
ONLY \$30 a box**

Please visit <http://www.itsupplies.com/museo> or call toll-free at 800-771-9665



**We bought the entire remaining stock
- but when they are gone, they are gone!**

Many thanks to IT Supplies.com (left) for helping sponsor this issue of Panorama. IAPP is always seeking corporate support in order to help carry out our association's activities. If you are a business owner or representative and wish to help, please contact Dave Orbock, IAPP President.

INTERNATIONAL ASSOCIATION OF PANORAMIC PHOTOGRAPHERS

NOVEMBER 1984

ORLANDO, FLORIDA

3 MONTH COUNTDOWN

THERE HAS NEVER BEEN, NOR PERHAPS WILL THERE EVER BE AGAIN, A CONFERENCE LIKE WHAT IS PLANNED FOR ORLANDO, FLORIDA, FEBRUARY 6-9, 1985. IT IS THE SECOND ANNUAL MEETING OF THE INTERNATIONAL ASSOCIATION OF PANORAMIC PHOTOGRAPHERS. IT ALL HAPPENS LESS THAN THREE MONTHS FROM NOW, AND DO WE HAVE THE SPEAKERS!

E. O. GOLDBECK

The "Dean of Cirkut Photographers" from San Antonio, Texas will be our feature speaker Wednesday evening. After 10 times around the world with his #10, he will be coming to Orlando right after returning from the only place on earth that he has never been, the Antarctica (of course with his #10). He will show and tell about many of his world wide adventures and his many historic photographs.

ANDREW DAVIDHAZY, ARPS

Associate Professor, Department of Photographic Technology of the School of Photographic Arts and Sciences, Rochester Institute of Technology. He is an authority on Strip and Streak Photography and Scanning Photographic Systems. His credits for published articles, photographs, consultant committees, lectures and exhibitions would take many pages to list. Strip photography is one of his favorite topics and he has made strip cameras from Polaroid pack film and standard 35mm cameras. He also owns a number 16 Cirkut camera.

RONNIE GLOBUS

Inventor, manufacturer of the GlobuScope line of 35mm, 2½ and 5" Panoramic Cameras plus the Superwide 4x5 and the Leveler, will be one of the manufacturers attending our Conference to show and tell about the GlobuScope products. When it comes to Panoramic Photography, Ronnie can get as technical as you want.



ADDITIONAL SPEAKERS

Page 1 listed only 3 of the 20+ speakers scheduled for our February Conference. The program hasn't been finalized as yet, our next mailing will contain the program. Other speakers scheduled to date are:

Bob Paluzzi Las Vegas, NV	Jack Rankin Ontario, CA	Charles Stover Norwalk, IA	Ron Klein Juneau, AK
David Paskin Reston, VA	Colin Bullard Australia	Harold Lewis West Newton, MA	Jim Lipari Omaha, NB
Ray Herbert Atlanta, GA	Charles Hulcher Hampton, VA	Ed Segal Washington, DC	Jack Davis Miami, FL
George Rosa Turner Falls, MA	Phil Foss, EKCo. Burke, VA	Jeff Aldrich Hampton, VA	Mark Segal Stelle, IL
Sylvia Dellamula Alpa Roto 70 Woodside, NY	Richard G. Fowler Orlando, FL		

HOTEL REGISTRATION

The enclosed envelope is for your attention and is to be returned to the Hotel. The Conference starts promptly at 2:00 PM, Wednesday, February 6, 1985. Arrange your travel plans accordingly. Fly in early and enjoy the sights of Orlando, the Vacation Capital of the World.

CONFERENCE REGISTRATION

This will be sent to you in our next mailing about the first of December.

USED EQUIPMENT FOR SALE

Anyone that has any used Cirkut and Panoramic Cameras or parts and/or pieces of any kind for any of these cameras (lenses, tripods, film, film magazines, gears, cases, darkroom printing equipment, old prints & negatives, etc.) please contact me prior to our next mailing, December 1, so I can publish it. Describe what you have for sale, your price plus shipping, plus your name, address and phone number. I also would encourage bringing used equipment to the Conference - your junk is another's treasure.



1ST ANNUAL PANORAMIC
APRIL
HAMPTON

MAILING LIST

It has now grown to over 200 names and addresses world wide. There are probably several hundred more names that we could add if only we knew who they are. Send names and addresses of anyone you know that is a Panoramic Photographer so we can check the names against our computer lists. I can assure you that I couldn't possibly put together this Conference with all the necessary correspondence, compiling and storing the mailing list and printing all the mailing labels without my computer and printer. How did we ever live without these great inventions?

OUR NAME CHANGE

Our mailing lists include many people from many countries active in Panoramic Photography. We are therefore "International" in scope thus the change to "International Association of Panoramic Photographers." It has a nicer meaning to our group and gives it alot more stature. Those I spoke to about the idea said it sounded great to them - why not!

PUBLICITY

Letters have been written to many sources to publish our Conference data and dates, hopefully we will get some response. Rangerfinder Magazine has contacted me about publishing an article in the December or January issue about Cirkut Cameras, our Association and the February Conference. That will be great timing and publicity.

Norman Weisberg, Editor of The Panoramic Eye has also contacted me about "The Panoramic Eye #2" which he expects will be out at the end of the year. It will contain many articles and illustrations all pertaining to the art of Panoramic Photography plus a plug about our group and Conference. Send Norman your check for \$6.00 and receive your copy. He needs your support.

The Panoramic Eye, Box 394, Sound Beach, New York 11789

THE COVER AND CENTERFOLD PHOTOGRAPHS

Front left - Charles Hulcher, E. O. Goldbeck and Jim Lipari meet for the first time at Hampton, Virginia. Right photo - David Paskin and Ray Herbert along with Ray's gold plated #10 fully restored by Dave. Our centerfold group photograph by Jeff Aldrich of Images.



RAMIC CONVENTION
L, 1984
ON, VA.

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DEAR EASTMAN KODAK

Have written to the Great Yellow Father in Rochester about the possibility of Kodak stocking 8" x 6' and 10" x 6' rolls of 400 ASA Kodacolor and Tri-X film plus either 100 ASA Kodacolor or 160 ASA Vericolor III to compliment the B&W Vericrome Pan for exterior use. It has been requested that Kodak stock these emulsions and sizes so that any photographer could order as many rolls as needed through their local Kodak dealer.

And will Kodak cooperate and make these films available? We will have to wait and see. Miracles occasionally do occur!

GEAR, ANGLE, FILM CHART

At the First Conference in Hampton, I talked about the following chart and how you can estimate how much film you will use with a given lens and gear for what ever angle you wish to photograph. Each 12" of film shows what angle it will cover using the related lens and gear. It is my donation to the group. Anyone else have some data we can print and share with everyone?

F I L M	LENS"			GEAR			DEGREE ANGLE	
	10" G69	10.25" G66	12" G57	14" G48	15.5" G44	19" G36	21.5" G33	24" G28
12"	68	65	56	47	42	35	32	27
24"	136	130	112	94	86	71	65	54
36"	204	195	168	142	128	106	97	81
48"	272	260	224	188	171	140	129	108
60"	340	325	280	235	213	175	161	135
72"	408	390	336	282	256	210	193	162

CIRKUT FILM FOR SALE

Ed Segal, 316 F Street NE, Washington, DC 20002, Phone 202 543-2484 -- has fresh Cirkut film for sale: 10" x 6' Kodacolor 400 and Tri-X, plus 100' rolls of Vericolor III and Vericrome Pan for spooling your own lengths.

CONFERENCE GROUP PHOTOGRAPH

We need a volunteer to take our group photograph at the Conference. We can't have a Conference without a group photo. At Hampton there were two taken, one by Jeff Aldrich and another by E. O. Goldbeck and his grandson Ed Goldbeck. They were both excellent.

FROM OUR MAILBAG

Received a letter from J. E. Nathan, Sussex, England, he had our August letter passed on to him. He couldn't believe there were people around the world still using Cirkut Cameras. He stated since 1937 his company does about 500 school groups a year all over the UK with a number 10. Sent him data about our group, our Conference and the hopes he could attend.

The November issue of Photographic News (Shutterbug Ads) has a new column and a new columnist, Barrie Smith from Australia. It is interesting, informative and with a touch of humor - it's all about Panoramic Photography.

IS YOUR NAME & ADDRESS CORRECT?

Even though you received this newsletter, was your name, address and zip correct? If not, please advise me of your correct data so that I can update our computer list.

Richard G. Fowler
1739 Limewood Lane
Orlando, FL 32818 USA

Phone 305 293-8003

Panoramas: Compositions on a Small Scale

*By Kenneth Setzer
Miami, Florida USA*

Like so many photographers, I am on a tight budget, and am always looking for alternate methods to accomplish my goals. I love macro photography, and wanted to produce a macro image that could be printed at a huge size, without loss of quality due to enlargement. I shoot purely digital, so I know that upsampling is generally not an option for increasing the size of a print — at least not the best.

Now I was faced with this challenge: to produce an image, this time of an insect, that could be printed at larger-than-life size, while maintaining high-enough resolution to produce a sharp and detailed print. I set up my subject inside a homemade softbox (basically positionable halogen lights and a seamless white background). To attain color accuracy, I set a custom white balance in my camera. Otherwise, since I planned to extract the subject from the white background, I wasn't overly concerned about the background.

This particular insect is a very dark to medium brown, so the white background provides strong contrast, which in turn aids in extracting the subject from the background inside Photoshop (I'm using Photoshop CS4).

While doing some test shots, I was able to easily fill the frame with the beetle. This would give a nice, large, detailed shot, but I wanted a final file that could be printed way larger than life size. I suddenly had a realization: my 100mm macro lens can focus close enough so that this rather large beetle extends outside the frame. Excellent! Why not take multiple images as

close as possible to my subject, and combine them into a panorama, a macro pano?

With my beetle in place, and camera on a tripod, I was able to get the 100mm macro lens to focus as close as about 9 inches away from the beetle. At this range, it took four shots to capture the entire thing. Starting at one end, I simply moved the camera a few inches for the next shot, keeping my exposure settings the same for each. It's also very important to overlap each shot with about one quarter of the preceding image. This way, the software will have a good amount to work with when blending the shots together.

When I was satisfied I had achieved acceptable photos, I opened the raw image files in Adobe Camera Raw (ACR), and further adjusted the white balance to correct a bit of a yellow cast visible on the white background. Since I had a white background, it was simple to use the white balance tool in ACR, since I could click the background, thus "telling" the software what area was supposed to be white. The only other adjustment I made in ACR was to bump up the vibrance to bring back some of the deep orange and brown in the beetle's exoskeleton. Then, simply clicking "Open" opens the raw file in Photoshop.

It's important to remember not to make the usual adjustments in Photoshop at this point. I normally would apply a filter to reduce any digital noise, sharpen the image, and look for any flaws to fix or color/luminance adjustments to make, e.g. increasing contrast. Resist making any such edits at this stage, since we are only dealing with one piece of the puzzle, and if applied to each piece separately, the edits you make might make it obvious that the final product has

Image 1: Thumbnails of the four files to be combined into one panorama.



Compositions on a Small Scale, *continued...*

been stitched from multiple pieces! We want to make adjustments to only the final, combined panorama.

When you have all your images to be merged open, save each as a separate file. I chose to save them as tiff files, because there's no loss of quality due to compression. The tiff file sizes are consequently huge; you could instead save them as high-quality jpegs without a problem. When merging, jpegs might actually be preferable, since Photoshop will be merging multiple documents, and with each one possibly many megabytes, the program can freeze!

Now the real fun begins. With Photoshop running, go to "File>Automate>Photomerge." A dialog box will open. First, under "Source Files," you'll need to choose which files you want merged. You can either navigate to the files by clicking the "Browse" button, or if they are already open, click the "Add Open Files" button.

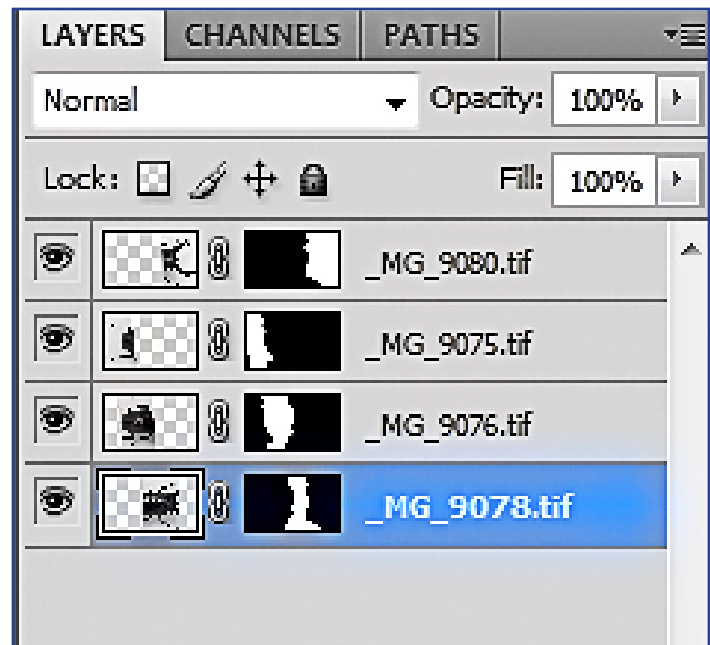


Image 3: Merged images on separate layers with layer masks.

CS2, which lacks automatic vignette removal in Photomerge. I merged some landscape photos, only to see vignetting in the corners of what were the original shots!

When you are all set, click the "OK" button, and watch the magic. Be patient — this is a demanding task, and can take quite a few minutes. When the process is complete, a new document will open. If you look at the layers panel, you will see you have the original images, each on a separate layer, and each layer also contains a layer mask. You can see Photoshop used the mask to hide or reveal portions of each layer to best blend the layers into one image. This would take a huge amount of work to do manually.

And here is the result of merging four separate photos into one: (Image 4). I inspected it at 100% of actual size, and the merged sections looked great. Sometimes the masked areas need manual editing for a more accurate blend, but not this time. I saved the document, and then chose "Save As." Here's when you can pick to save a copy as a jpeg or tiff.

What you ultimately want is a flattened image, with all the layers merged into one. With the newly saved flattened image open I cropped out as much of the background as possible (seen in Image 4, next page left side) as black, but since it is actually transparent, Photoshop represents it as a checkerboard).

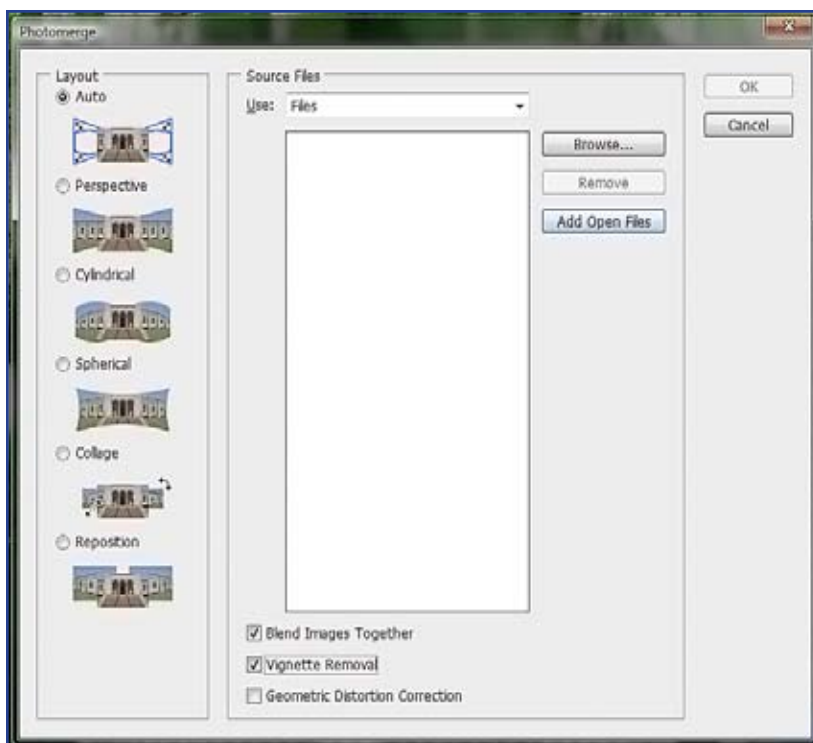


Image 2: Photomerge dialog box and options.

For the "Layout" options, I leave it set to "Auto" for this type of merge. Some of the others are suitable for landscapes where distortion may be a problem. Finally, the check boxes near the bottom: I check "Blend Images Together," since that's the hard part I want Photoshop to accomplish, and

"Vignette Removal" as well. The latter is new to the Photomerge function. I never realized how useful it is until I tried to create a panorama in Photoshop



You can spot the pin used to mount the beetle to its base. That was easily removed with the clone stamp and patch tools. Then I used a filter to sharpen the image.

With my camera shooting raw, the largest resolution I can get after processing the raw file is a photo sized to 16.2 inches x 10.8 inches at 240 ppi. That's with a 10.1 megapixel camera. At this point, with four of these shots merged to one, I have a 240 ppi, 29" wide x 15.8" high image (recall, there was a lot of overlap). But as important as the resolution, this image now has great detail and focus overall. I can print a nice panorama of a subject that is actually only about 3.25" long in life size!



I ultimately cut the beetle out from its background and blended it with some textures to go for a scientific illustration look. But you can use this technique for almost anything — still lifes, single isolated objects, cars, artwork. As a matter of fact, this is a good method to use when photographing art like paintings or sculptures. Anything that will sit still long enough for you to get your shots can be made into a panorama.

Ken Setzer is a photographer and graphic designer. His favorite subjects to photograph include insects, wildlife, anything old and unusual, and anything in danger of extinction. He enjoys his time behind the computer screen as much as behind the lens. His website is <http://www.pixatography.com>.

Panoramas from Albuquerque

Editor's Note: The recent Photo Safari at the Albuquerque International Balloon Fiesta was a great success and provided photographers from IAPP and IVRPA a wealth of pictorial possibilities. Over the next few pages (and on occasion in other parts of this journal) you will see an assortment of panoramas that showcase the talent and creativity of several safari attendees.

Captions for the images presented here are as follows

Top: Group photograph atop the Sandia Peak - elevation over 10,000 feet, by Dave Orbock.

Center: View of the Sandia Tramway with the city of Albuquerque off in the distance, by Jeffrey Orbock.

Bottom: Group photograph at the Plaza Inn Hotel in Albuquerque.

Pages 18 and 19 (next)

Top: Special Shapes "Glowdeo" at the Albuquerque International Balloon Fiesta, by Jeffrey Orbock.

Center: Special Shapes "Glowdeo" at the Albuquerque International Balloon Fiesta, by Jeffrey Orbock.

Bottom: Bandalier National Monument, by Richard Schneider.

Side: Homage to Georgia O'Keeffe's "Gerald's Tree", Ghost Ranch, near Albuquerque, by Peter Randall.

Page 20

Top: The "Gondola Club" at the Albuquerque International Balloon Fiesta, by Willy Kaemena.

Bottom: Group photograph at the summit of Sandia Peak, by Willy Kaemena.

Page 21

Assorted dining table group shots taken at Toco's in downtown Albuquerque. Of note is the image in the upper right of IAPP President Dave Orbock presenting an Outstanding Service award to Everen Brown, principal organizer, publicist and master of ceremonies for the 2009 IAPP/IVRPA Photo Safari. Photos by Richard Schneider.











by Willy Kaemena





Captions and picture credits for these and the photographs on the preceding pages can be found on page _____. All of these images were taken at the 2009 IAPP/IVRPA Photo Safari at the Albuquerque International Balloon Fiesta in New Mexico.

Photos on this page by Richard Schneider.

An Interview with Jaspal Jandu

Date of Birth: 22 August 1974

Where do you live? London, England

Website: www.jaspaljandu.com

E-mail: info@jaspaljandu.com

What is your background?

Through various studies and jobs, I have been involved in and surrounded by fine art and music throughout my life. Apparently, it is often said that playing music creates new pathways in your brain that stimulate creativity.

More formally, I majored in economics and it's something which I still enjoy to this day. There's a great quote from Leonardo da Vinci which states that one should aim to "...study the science of art and the art of science". I guess in this vein, it's healthy keeping one part of my brain active with photography and the other with something completely different now and again.

Why did you choose to be a landscape photographer?

My father was a prominent architect and I clearly remember being fascinated by the bewildering blend of art and science in his study room. After contemplating a similar career myself, I eventually chose to pursue a different discipline which could provide me with an equally rewarding mix of art and craft.

Eventually, as I began to travel with my camera I started to mature, both personally and professionally.

My previously embarrassing attempts at photography were soon crystallising into something more solid and the ratio of 'keepers' to 'losers' was increasing dramatically.

It was during this growth spurt that I began to realise how important and overlooked landscape photography is to the environmental debate. Returning to countries again and again, I would compile almost time-lapse images of, for example, glacial retreat and desertification. Given the resonance of such images with the general public and art editors alike, I eventually resolved myself to a career in landscape photography.

Why panoramic?

I have always been absorbed by the intrinsically epic panoramic format. For example, I'm sure if you watched Lawrence of Arabia or Lord of the Rings in a square aspect ratio, you would inevitably lose some of the sweeping cinematic experience contained within. The panoramic frame - especially when printed large and viewed close - requires the eye to scan from side-to-side and this perfectly complements the way the brain works in real life.

What special considerations are required for the panoramic format?

Due to the small vertical aspect, it is important to create a 'start-middle-end' narrative that suits the letterbox format. Interestingly, I often find many of my clients who reside in the Western-world prefer this narrative to read from left to right - partially as a





response to the dominate style of the written word in such areas.

In technical terms, there is noticeable light fall-off towards the edges of the large-format image circle and, therefore, a centre filter is often required to correct for this; although recently I have been experimenting with the

aesthetics of 'drawing' viewers into the scene via the deliberate removal of the filter.

Lastly, I am always at pains to note that the panoramic format must be a totally immerse endeavour - you really have to live and breathe the aspect ratio in order to get the best results. I once had the dreadful experience of trying to use three formats - 35mm, 617 and 4x5 - on a trip. The fact that I did not manage to capture a single shot during the week long period speaks volumes for the focus required.

What is your current project?



My main focus at the moment is publication of a new book entitled 'Natural Wonders: A Panoramic Vision'. It covers over 25 countries on earth and highlights the fragile state of the world's ecosystem and our shared destiny within it. It has taken over 4 years to complete and all the images are presented in my preferred panoramic format.

Did you have to prepare yourself for this journey, if so for how long and how?

The journey itself has taken around four years with the single continuous stretch of around 1.5 years.

Being based in England, it has been relatively easy to take cheap flights to, say, Scotland or the Alps. Given that everything is so accessible in Europe, I often find that there is not really that much to prepare for.

Most of Africa was completed in one rather long and adventurous visit. Starting in Tanzania for Mount Kilimanjaro and the Ngorongoro Crater, the voyage went on to the Serengeti (Kenya), Drakensberg (South Africa), Sossesvlei (Namibia) and Victoria Falls and Mana Pools (Zimbabwe).

As I was also shooting digitally by this stage, my main worry was battery power and memory storage. I was also concerned about camera safety and sand/dust but in the end both of these issues proved to be easily surmountable.

The long continuous trip of 18 months was much more difficult because of the geographies and climates involved. It took about two months to agree the schedule and organise the gear (packing swimming trunks alongside snow crampons was interesting). I ended up producing a huge hand-drawn map with all the natural wonders accompanied by the seasons, visa requirements, flight time tables and the like. By the time it was time to leave for the trip, I honestly felt equally exhausted as I did excited.

What was the biggest catastrophe and what was the happiest moment on the trip?

The single biggest set-back occurred in Venezuela. As I was attempting to capture the grandeur of Angel Falls, a rumour began to spread that I was a journalist from National Geographic who was overtly photographing local people without the necessary permits. Needless to say, having the Minister for Indigenous Affairs and four armed guards pounding on my bedroom door at 4am in the morning wasn't the most pleasant of experiences. After a fairly heated debate, I managed to get all of my camera gear back but by then I had lost crucial shooting time in my very short stay in the country.

My fondest memories are of touring the American Southwest. Hiring a camper van and traipsing through such awe-inspiring scenery such as Canyonlands and Monument Valley should be standard rites of passage for everyone. Not only did it yield some literally jaw-dropping pictures but it also convinced me that the best photographs are made when the connection with the land is at its strongest.

An Interview with Jaspal Jandu, *continued...*



Did the scope of the project and the sights you witnessed teach you anything about yourself and your skills? Do you feel this has changed you in anyway?

Given the size and scope of the journey, it was inevitable that I would change during the course of it. Professionally, I think I am getting to the point where I am more worried about the art and not the craft. There's a universal four-stage model of learning which may help to explain my thinking:

1. Unconscious Incompetence – Before you ever pick up a camera, you are blissfully unaware of your inability to take a photograph!
2. Conscious Incompetence – As you begin to learn the craft, there is a sudden realisation that you know very little about it.
3. Conscious Competence – By stage, you can methodically use your equipment and compose relatively good images.
4. Unconscious Competence – The neural paths are now well developed. Things like set-up, composition, metering and exposure are being handled by the sub-conscious. Most importantly, one can now concentrate on higher order artistic functions to help with the transmission of hopes, thoughts, fears and desires through the medium.

In terms of personality, I am not sure of how much the project has changed me. For example, when I first jotted down my proposed adventure many years ago, I do recall thinking that it was too big an

endeavour for a single individual. However, if I were to do something similar today, I am pretty sure that I would think even bigger! So, in that vein, my tendency to 'think big' hasn't changed at all in the intervening years...

What are your expectations now?

Unfortunately, one of the burdens of being a perfectionist is that I always set my expectations impossibly high. I am striving to release a new book on London fairly soon and also embarking on the sequel to 'Natural Wonders'; heading off again on another voyage to capture the world cloaked in beauty and fragility.

Separately, I am also cognisant of the relentless advances in photographic technology. Although I'm not sure if I'll end up shooting the next volume in something ridiculous like holographic format, I do have hopes of remaining at the forefront of this wave.

What reaction would you like to receive from your viewers?





To have inspired others into both photography and environmental conservation would be an honour. More rudimentarily, given the sacrifice behind some of the pictures, a plain old-fashioned 'wow' would also be nice!

What gear did you use, and film stock?

I'm not really a 'gear-head' and am always at pains to point out that a camera is ultimately a tool which helps

us to communicate our hopes, thoughts and desires to others. However, having said this, I am also cognisant of the fact that photography is a craft and therefore relies heavily upon the tools of the trade.

To this end, my primary camera is the Linhof 617 SIII. In terms of ruggedness, usability and sharpness, I have found nothing comes close. Although I tend to favour the use of both the Super Angulon 90mm and 72mm lenses (equivalent to ~19mm and ~15mm respectively in 35mm terms), I also use the 180mm lens for more telephoto / abstract work. Fuji Velvia 50 (both 120 and 220 formats) is the colour film of

choice with TM ax 100 used for black and whites. I have tried the new Velvia 100 Professional and found it not to my liking (particularly its handling of the red spectrum), so I am currently using the new Velvia 50 II. A Sekonic light meter, Lee filter set and Manfrotto tripod round off the main tools.

Latterly, I have also begun using Canon digital cameras. A variety of lenses accompany me including the 14mm, 17-40mm, 24-105mm and 100-400mm. Having both the Linhof and the Canon is really a dream combination. Whilst the former handles epic landscapes in its stride, the latter comes into its own with fast moving and/or variable ISO scenes. Covering every known biome - forest, aquatic, desert, grassland and tundra - in the course of my journey, I can personally vouch for how good modern cameras have become.

What did your travels teach you about the panoramic format?

My travels taught me that the panoramic format can simultaneously be your closest friend and your fiercest foe...

Whilst I was shooting the magnificent Southern Alps of New Zealand, I very much wanted to present the mountains as the 'main attraction' in each frame. Therefore, by cropping away redundant areas of foreground and sky, the format perfectly suited the artistic task at hand.

However, roles were reversed in narrower confines. I remember having huge headaches in



An Interview with Jaspal Jandu, *continued...*

Yosemite National Park, for example, given the steep, vertiginous walls and the narrow valley floor. In such circumstances, I often found it easier to either switch to the vertical format or to concentrate on smaller details - such as a flowing stream, for example - in order to get the most out of the frame.

What advice would you give a panoramic-specialist in the field?

My primary advice is not to listen to any advice!

For example, it is not uncommon to come across 'panoramic viewpoint' signs whilst on the road. Whilst these would imply a perfect place to set-up one's camera, I have often found that they are simply areas of higher ground which afford broad views over large expanses of land and/or sea. In fact, combined with little or no foreground interest, they often result in the worst panoramic viewpoints possible.

Indeed, it is far better to put on your boots and explore your chosen region to the best of your own ability. Quite often, the most secluded and unexplored areas will yield the best and most unique panoramic compositions.

What do you think of advances in digital panoramic technology?

I am a big fan of digital technology and there is no doubt that it has liberated us from the painful and environmentally damaging darkroom process (however, modern cameras, computers and hard drives all have to be powered somehow and, therefore, it is not quite the zero sum game that many people assume).

Although dedicated, digital-backed panoramic cameras aren't quite there yet in terms of manageability, I am sure they aren't that far away

from the horizon. Digital stitching is also a fast-growing niche and I am sure that the next generation of hardware and software is going to make it ever easier for people to get into this wonderful format.

What is your favourite ingredient for a good photo?

Light is the most important ingredient for the good photo, period. In this regard, my most favoured condition is the fleeting glimpse of golden light which sometimes occurs through a slit in the clouds at sunset or sunrise. The resulting contrast of rich foreground with brooding blue and ochre clouds is pure photographic manna from heaven, in my opinion.

Concluding thoughts?

During the course of my journey, I have been blessed to encounter many like-minded individuals and organisations who are dedicated to the preservation of our areas of outstanding natural beauty. They are too numerous to mention, but World Heritage bodies, environmental organisations and National Park authorities all command my total respect for the work they undertake. Irrespective of where they are based, they have all highlighted to me that man has just as much power to solve problems as he does to create them. Lastly, I am often asked about the genesis of this project. Why would one commence the long journey to document the natural wonders of the world? In a twist on Mallory's famous quote, my instinctive answer is: "...because in the future, they may not be there". I hope this can serve as the salutary ethos behind my body of work.

Captions

Page 21-22: "Oasis" Havasu Falls, Grand Canyon, USA

Page 23-24 (top): Mount Parinacota, Chile and Bolivia

Page 23-24 (bottom): "Divine Light", Alaska, USA

Page 25: White Sands National Monument, USA



Book Review

*By Dave Orbock
Baltimore, Maryland USA*

NATURAL WONDERS : A PANORAMIC VISION

By Jaspal Jandu

First published 2009 by Jaspal Jandu Ltd

British Library Cataloguing in Publication Data:
779.3'092. ISBN-13: 9780956081803

This beautiful book of Panoramic Photographs speaks for itself. The images in the book are organized around 5 continents (North America, South America, Europe, Africa, and a place called "Australasia") and it contains 152 pages with 90 photographs including 48 double page spreads and a few aerial views. His images, as suggested by the title, are "natural" and not created or directly altered by man.

I have been to quite a few of the places featured in this book and they bring back pleasant memories. Having just visited the Giant's Causeway (Northern Ireland), I can still vividly picture the beautiful basalt crystals and marvel at Jaspal's images, absent people. Also, it hasn't been all that too long ago that I was in Banff, Denali, Yosemite, and the Colorado Plateau. All places beautifully recorded by Jaspal.

In the introduction to each section he briefly discusses the economic and environmental issues affecting the region along with the changes produced to our natural environment. He is hopeful that these natural wonders will last for future generations; but, in case they don't, those coming after us will still have his images as proof that they once existed. He is rightly concerned that the "world's natural wonders demand our action to preserve them".

Jaspal's field notes explain his selection of images for this book. He discusses his photographic equipment, film and preferred format. I agree with his conclusion that it is very difficult to mix formats, i.e., 35mm, 6x17, and 4x5, on a photographic trip and come away with many decent images.

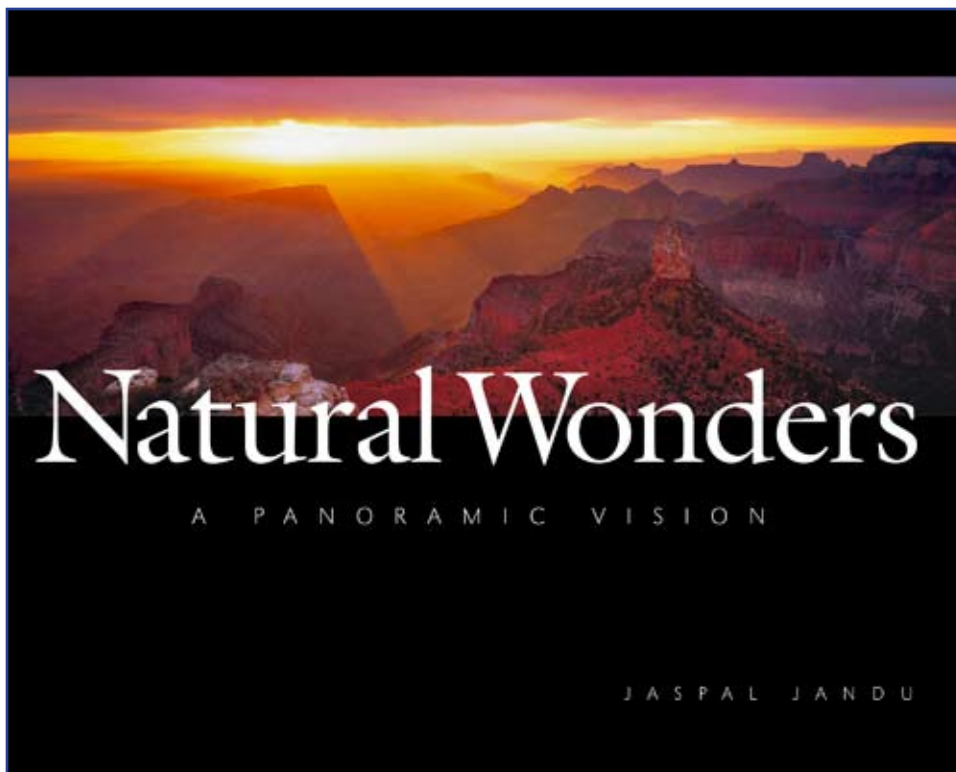
Jaspal is a member of IAPP. More information on his travels to produce this book is available at www.jaspaljandu.com.

Refer to webpage :
<http://www.jaspaljandublog.com/natural-wonders-media-images.html>

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Dates & Venues previous exhibitions

- Natural Wonders: A Panoramic Vision (the.oxo@gallery, London, 2009)
- A Perfect World (Gallery 77, London, 2008)
- Britain on View Exhibition (the.oxo@gallery, London, 2008)
- Eyes to Wonder Exhibition (Calumet, London, 2007)
- Porsche Collaboration (Dubai, 2006)
- Natural Vision (Amman, Jordan 2006)



A Color All-Sky Panorama Image of the Milky Way

By Axel Mellinger

Dept. of Physics, Central Michigan University
Mount Pleasant, Michigan USA

Editor's Note: The cover image, as well as this article, are copyrighted by Axel Mellinger and have been reproduced in Panorama only by permission from the author. The text has been edited down slightly from the full article that was included in the November 2009 issue of the Publications of the Astronomical Society of the Pacific 121:1180–1187. For more information about Axel's work, please visit his website at <http://home.arcor.de/axel.mellinger/>

ABSTRACT

This article describes the assembly of an optical (RGB) all-sky mosaic image with an image scale of 36" pixel, a limiting magnitude of approximately 14 mag, and an 18 bit dynamic range. Using a portable low-cost CCD camera system, 70 fields (each covering $40^\circ \times 27^\circ$) were imaged over a time span of 22 months from dark-sky locations in South Africa, Texas, and Michigan. The fields were photometrically calibrated against standard catalog stars. Using sky background data from the Pioneer 10 and 11 space probes, gradients resulting from artificial light pollution, airglow, and zodiacal light were eliminated, while the large-scale galactic and extragalactic background resulting from unresolved sources was preserved. The 648 megapixel image is a valuable educational tool, being able to fully utilize the resolution and dynamic range of modern full-dome planetarium projection systems.

INTRODUCTION

Since ancient times, astronomers have sought to draw maps of the sky, similar to their cartographer colleagues' drive to produce ever more accurate maps of the Earth. However, it was not until the invention of photography that faint, large-scale structures of nebulae and dust lanes could be faithfully reproduced.

Since the late nineteenth century, several visible-light, wide-angle photographic surveys of the sky have been completed, such as E. E. Barnard's Atlas of Selected Regions of the Milky Way (Barnard et al. 1927); the National Geographic Society-Palomar Observatory Sky Survey of the northern sky (Minkowski & Abell 1963) and subsequently the equivalent ESO/SERC atlas of the southern sky; and more recently, the Sloan Digital Sky Survey (York et al. 2000). Very recently, the European Southern Observatory (ESO) released a Milky Way panorama image photographed by S. Brunier as part of their Gigagalaxy Zoom project.

In 2000, the author published an all-sky color image taken on photographic 35 mm color film with a focal length of $f \frac{1}{4} 28$ mm. A total of 51 images were computer processed into a mosaic measuring 14400×7200 pixels, equivalent to an image scale of 90" pixel.

This picture is now widely used for educational purposes in planetariums, exhibitions, and textbooks; it formed the basis for a photographic star atlas (Mellinger & Hoffmann 2005), and illustrates the location of star-forming regions in the Milky Way (Mellinger 2008). With recent advances in digital projection technology, demand grew for both a higher spatial resolution and a higher dynamic range.

The article describes the assembly of a 648 megapixel mosaic from more than 3000 individual CCD images.

DATA ACQUISITION

Hardware: CCD Camera

Wide-field imaging equipment based on commercial camera lenses has been successfully used in the past for, e.g., emission-line surveys (Gaustad et al. 2001) and measurements of the night-sky brightness (Shamir & Nemiroff 2005; Duriscoe et al. 2007). After exploration of several camera systems on the market, an SBIG STL-11000 CCD camera was chosen due to its

1. Moderate cost,
2. Large sensor size (36 mm \times 24 mm),
3. Antiblooming gate (eliminating the need for software de-blooming), and
4. Compact construction (low back focus, allowing the use of 35 mm camera lenses).

The camera uses a Kodak KAI-11002 chip, a 4008 H \times 2672 V progressive scan interline CCD image sensor with an antiblooming gate (Eastman Kodak Company 2006). It uses microlenses to enhance its quantum efficiency by directing light to the active pixel areas.

Hardware: Lens

The camera was fitted with a Minolta MD 1:4/50 mm lens originally used on a 35 mm format film-based single-lens reflex camera. To improve the image quality, the lens was stopped down to $f/4$ for all exposures.

Hardware: Filters

As the principal purpose of the panorama image is to create a visual representation of colors in the sky, an RGB filter set (Astronomik Type 2c) was used instead of the Johnson UBV filters common in photometry.

Field Selection:

The KAI-11002 chip has an active area of 36×24 mm², resulting in a field of view of approximately $40^\circ \times 27^\circ$ at a focal length of $f = 50$ mm. Due to the location of the mounting thread on the camera, a “portrait” orientation of the camera was chosen, with the long side of the chip being parallel to circles of constant right ascension. To ensure a seamless mosaic, adjacent fields had to overlap each other by at least 15% of the respective offset in right ascension or declination. With these constraints, a coverage pattern was developed by way of trial and error.

Exposure Times:

In order to increase the dynamic range beyond the 16 bits of the camera’s analog-to-digital converter (of which approximately 12 bits provide data above the noise level), three different exposure times (240 s, 15 s, and 0.5 s) were used. Five frames were taken for each exposure time and filter setting.

Sites:

The fields centered at declinations -90° , -62° , -32° , and 0° were taken in 2007 October and 2008 March/April from dark-sky locations in South Africa, while the northern hemisphere images (declinations $+32^\circ$, $+62^\circ$, and $+90^\circ$) were taken between 2008 December and 2009 August from dark-sky locations in Texas and Michigan in the US.

DATA PROCESSING

Preprocessing:

The standard preprocessing steps (dark-frame subtraction, masking of bad pixels, division by flat frame) were applied to all images. Due to its microlenses, the angular quantum efficiency of the CCD chip depends upon the angle of incidence. This angular profile in turn is a function of the wavelength (Eastman Kodak Company 2006).

Hence, flat frames taken through the R, G, and B filters differ significantly. Depending on the spectral distribution of the sky background, this wavelength-dependent sensitivity of the camera system may lead to residual gradients, even with proper flat-frame calibration.

Next, the images were upsampled by a factor of 3. Although it increases the file size by $9\times$, this step was found to be necessary in order to minimize the loss of resolution in subsequent resampling with bilinear interpolation. Higher-order interpolation methods, such as bicubic or Lanczos resampling, could not be used as they introduce ringing artifacts in undersampled images.

Astrometric Calibration:

Wide-angle imaging requires careful astrometric calibration, taking into account distortions of the camera lens beyond a simple gnomonic projection. In each raw image, up to 1500 reference stars were automatically selected using the Source Extractor software (Bertin & Arnouts 1996) and pattern matched against sources in the Hubble Guide Star Catalog 1.2 (Morrison et al. 2001). With these reference stars, an astrometric solution was calculated using custom software, and a world coordinate system (WCS) header was added to the FITS file. For each field, all images with a common exposure time and filter setting were then resampled and co-added with the SWarp software (Bertin et al. 2002). Finally, all pixels in the 240 s frames that were masked as saturated were replaced by scaled pixel values from the 15 s or 0.5 s frames using the IRAF imexpr task.

Photometric Calibration:

A major problem was the photometric calibration of the individual fields. A straight combination without photometric corrections yields a patchy-looking mosaic. Clearly, the sky background level varies significantly between fields, and some fields exhibit strong intrafield background gradients. Moreover, differences in atmospheric transparency may cause the recorded flux I of a star to vary between two frames.

Contributions to the Sky Background:

The diffuse night-sky background has a variety of sources (see Leinert et al. 1998 for an in-depth discussion):

1. Light pollution. Although most images were taken from dark-sky sites (class 1 on Bortle’s scale (Bortle 2001), time constraints dictated that some fields were taken from sites with slight artificial light pollution (the Michigan sites have Bortle class 2 or 3). In addition, again due to time constraints, some images were taken in the evening sky before the end of astronomical twilight, or in the morning sky past the beginning of astronomical twilight.
2. Airglow. In the absence of light pollution, airglow is the largest contributor to the night sky brightness (Leinert et al. 1998). In the visible spectrum, the main sources are atmospheric O₂ and OH. Air-glow is highly variable both in spatial distribution and in time.
3. Zodiacal light. Zodiacal light is sunlight scattered by interplanetary dust particles. Near the ecliptic poles, its intensity in the visible spectrum is typically 2–4 times weaker than air-glow, but it gains significantly as the field of view gets closer to the sun. Due to its spatial confinement to the ecliptic

Panorama Image of the Milky Way, *continued...*

region, it can cause strong background gradients in wide-field images.

4. Tropospheric scattering. Starlight as well as airglow and zodiacal light are scattered in the troposphere. High clouds as well as high humidity at ground level can enhance scattering and lead to halos around bright stars.

5. Integrated starlight. Another contribution to the sky brightness is the light from unresolved stars. At visible wavelengths, it is dominated by main-sequence stars (Leinert et al. 1998).

6. Diffuse galactic light. Diffuse galactic light (DGL) is produced when starlight is scattered by dust grains in interstellar space.

7. Extragalactic background light. Light from galaxies that are not individually detected.

Many of these contributions to the night-sky brightness are undesirable in an all-sky mosaic image. Light pollution, airglow, zodiacal light, and tropospheric scattering vary between individual fields, as well as within a field, and thus should be removed in the calibration process. However, the contribution from unresolved stars and the diffuse galactic light are features of the Milky Way and should be preserved, together with any extragalactic background. This creates a major calibration problem, as we need to decide on how much of the local background is caused by unwanted sources (1–4 in list) or galactic and extra-galactic contributions to be retained (5–7 in list).

This problem has plagued a number of ground-based studies of the galactic background (Leinert et al. 1998). However, these effects can be separated using space-borne visual photometry data from the Imaging Photopolarimeters (IPPs) onboard the Pioneer 10 and 11 space probes. Their data were obviously not contaminated by terrestrial sources, and the zodiacal light contribution became negligible for distances above 3.3 AU.

Final Assembly and Color Processing:

The scaled and background-corrected images were resampled and co-added using SWarp. This software can be configured to generate a range of projections defined in the FITS/WCS standard (Calabretta & Greisen 2002), including Hammer-Aitoff, equidistant cylindrical (plate carrée), and equidistant azimuthal. In addition, a number of target coordinate systems (equatorial, galactic, etc.) are available.

The resulting R, G, and B fits images were converted to a single RGB TIFF file using the STIFF software. This program converts the 32 bit floating-point brightness values to 8 bit numbers by applying a nonlinear transfer function to the luminance

channel only. This way, bright objects do not appear “burnt out” as is often seen in images where the transfer function is applied directly to the R, G, and B channels (Lupton et al. 2004).

RESULTS

The above procedure created a $360^\circ \times 180^\circ$ panorama image of the entire sky at a scale of $36''$ pixel, equivalent to a size of 36000×18000 pixels. With each pixel represented by a 32 bit (single precision) floating-point number, each color channel is approximately 2.5 gigabytes in size. The faintest visible stars are approximately 14 mag, while only stars brighter than +0.7 mag are saturated. (This saturation could have been avoided by reducing the shortest exposure time below 0.5 s, but this would have reduced the number of reference stars suitable for astrometric calibration.) Hence, the dynamic range is approximately 18 bits.

In the earlier panorama (Mellinger & Hoffmann 2005), many of these details are missing due to the rather aggressive flat-fielding employed at the time. In an historical context, the panorama image may be compared to the hand-drawn maps of Gaposchkin (1957) and the first all-sky image in Aitoff projection by Lundmark, as well as to early photometric studies of the Milky Way (Pannekoek et al. 1949).

Besides galactic stars and nebulae, and some brighter extra-galactic objects (most notably, the Magellanic Clouds and the Andromeda Galaxy), the panorama image also shows a number of solar system objects. In most cases, the bright planets could be avoided by scheduling the exposures for times when no planet was near the field of view. No attempt was made to remove or



avoid solar system objects invisible to the naked eye. A comparison with the very recently released ESO Gigagalaxy Zoom Milky Way panorama shows that both images were photographed at the same focal length of $f\frac{1}{4}$ 50 mm. Brunier made his panorama with a Nikon D3 camera which has a non-cooled 36×23.9 mm² sensor with 4256×2832 pixels and a color filter array (CFA). Its pixels are about 6% smaller than those of the STL-11000; however, the demosaicing process required for CFA sensors (Gunturk et al. 2005) would lead to some loss of spatial resolution. No information on the dynamic range and photometric calibration of the ESO image is currently available, although the use of a single exposure time (6 minutes) suggests a dynamic range significantly lower than the 18 bit range of the image described in this article.

APPLICATIONS

First and foremost, the all-sky mosaic image is expected to be a valuable educational tool. Modern digital full-dome planetarium projection systems offer 12 bits of resolution per color channel, with 16 bits not too far down the road. With an 18 bit

dynamic range, it will be possible to blend over from a view showing only the brightest stars (simulating the view in a light-polluted environment) to a full display of the faint star clouds and nebulae in our Milky Way. The resolution of $36''$ pixel ensures crisp star images that will be limited by the resolution of the projection equipment and the observer's eye, rather than the image data. As the size of the image (7.5 Gb for a 32 bit floating-point representation) may exceed the capabilities of some personal computers, an Open-EXR version is in preparation. This file format uses 16 bit (half-precision) floating-point numbers for storing the image data, thus reducing the file size by a factor of 2.

In addition to its use in education, the image is also of scientific value, as it supplements earlier work on the surface photometry of the Milky Way, such as Hoffmann et al. (1998). As an example, studies of the night sky background (see, e.g., Duriscoe et al. 2007) need to discern between man-made light pollution and natural contributions to the sky brightness (a problem very similar to the one encountered in the present work), and would thus benefit from photometric data on the Milky Way brightness.





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