

## Will Polyimide Shortage Ease Anytime Soon?

Are there signs that the polyimide shortage that has gripped the flex circuit industry is about to ease? Ease maybe, but demand will probably remain strong.

Folks have told me that they are having some trouble getting thicker polyimide to use for stiffeners. Wherever possible they are steering customers to specify stiffener materials other than polyimide. I have had trouble with flex makers in the Far East not able to get laminates with thicker polyimide for controlled impedance applications. Are the polyimide makers using any extra capacity to make only one mil and half-mil films?

Numbers from IPC show the book-to-bill ratio for flex circuitry dipped below 1.0 in August for the first time since January. It had been 1.50 or higher since March and has high as 1.87. It bounced back up to 1.38 in September.

Throughout *The Flex Circuit News* there are links to the web pages of those companies or individuals mentioned in the articles, as well as links to advertisers web pages. Look for the pointing finger.



## Road Trip...

### Tracking Lasers In The Pacific Northwest

I have been trying to find an excuse to visit the Pacific Northwest for a long time. Back in my college days I spent two summers in the Pacific Northwest - one in Portland and one in Seattle. I haven't been back since then, but I'd never forgotten the natural beauty of the land or the warmth of the people. Then I realized that I haven't written about laser processing of flex circuits in over six years. Another thought - several laser service providers and laser manufacturers are located in the Pacific Northwest. I'm there!

**Tom Woznicki**

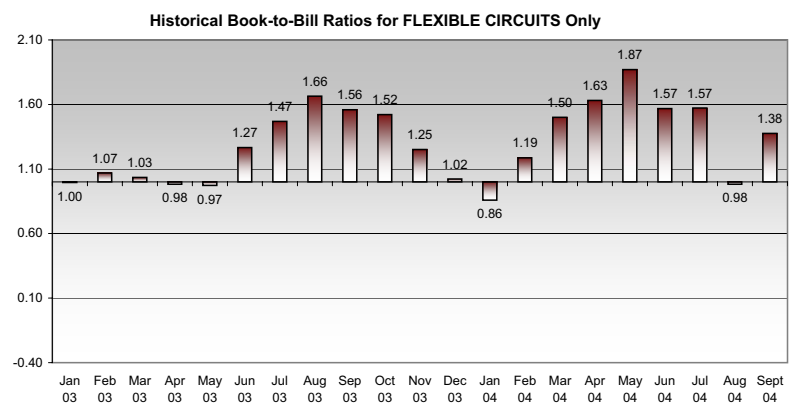
As a designer I love designing with laser processing. Normally, I try to steer my customers away from leading

(Continued on page two)

Will the trend toward slider phones reduce the flex circuit demand? Maybe. Apparently the sliding action does not require as much flex circuitry as flip phones, but others say that the more features you have the more flex you need. Besides, there are still plenty of flip phones being built.

On the horizon - DuPont will open a new polyimide line at their plant in Tokai, Japan in January. This facility is a joint venture with Toray Industries of Japan. The new production line will increase capacity at this facility by 40%.

DuPont's is also working with Samsung to create a joint venture called SD Flex to make adhesiveless polyimide laminates for the Korean flex market in third quarter of 2005. With all the cell phones and displays made in Korea this is bound to help, don't you think? Let's hope.

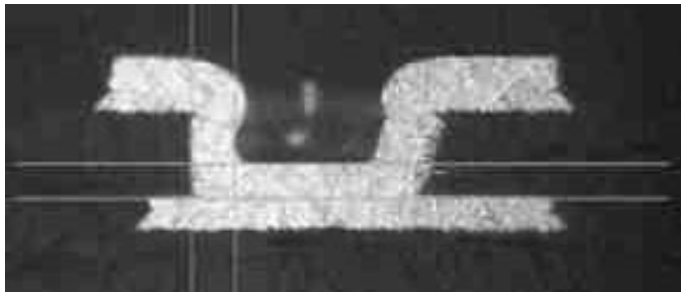


Graph courtesy of IPC.

edge technologies because they increase cost and limit vendor choices. But when you need features not achievable with normal tooling, laser processing is a great way to build really trick circuits - often with only a modest cost increase.

### Microvias

Lasers can drill vias well below four mils - in fact they can drill holes smaller than most vendors can plate! Even better, lasers can easily make blind vias - holes that go through one layer of copper but stop at the second. Blind vias can really increase the routing density of the circuit - especially if your application requires pads-only plating. Without a hole or plating mask to route around you can fit more traces on the second circuit layer.



Cross section of a blind laser-drilled via.

*The Flex Circuit News* is an industry newsletter published by Flex Circuit Design Company in San Jose, California. It is dedicated to providing information about all aspects of and promoting the use of flexible printed circuits in interconnection and electronic packaging.

*The Flex Circuit News* is a free publication that is delivered to subscribers by e-mail.

Flex Circuit Design Company is a consulting company that specializes in designing flexible printed circuits for OEMs and flex circuit manufacturers.

© Copyright 2004, Flex Circuit Design Company  
All rights reserved.

Got a question?

Send e-mail to [tom@flexdude.com](mailto:tom@flexdude.com)  
or call  
408-629-8343

[www.flexdude.com](http://www.flexdude.com)



### Skiving, Outlines and Flying Leads

Of course lasers can do lots more stuff than microvias. With a narrow beam they can cut tight slots and intricate outlines or make very precise openings in the coverfilm prior to lamination. How precise can they be? Well, the picture on below is a human hair with that is only three mils wide. The letters made by an laser from Electro Scientific Industries (ESI) are only one mil tall!




Writing on a human hair. Photo courtesy of ESI.

Removing film and adhesive after lamination to expose a copper pad underneath is a process called skiving. Skiving can also remove all the film and adhesive in a certain area, leaving the trace suspended in air. These flying leads are used for


## UNI-FLEX CIRCUITS

Your One-stop Shop for Quick-turn Flex Circuits  
Quality Products, & Exceptional Service



- ◆ Single, Double & Multilayer Flex Circuits
  - ◆ Cost Effective
  - ◆ Prototype to Medium Quantities
  - ◆ Engineering and Design Support
  - ◆ 24-hour Fabrication Available

Uni-flex Circuits  
 1782 Angela Street • San Jose, CA 95125  
 Ph: (408) 998-5500 • Fax: (408) 998-5505  
 Email: [uniflexcir@aol.com](mailto:uniflexcir@aol.com)  
[www.hometown.aol.com/uniflexcir](http://www.hometown.aol.com/uniflexcir)



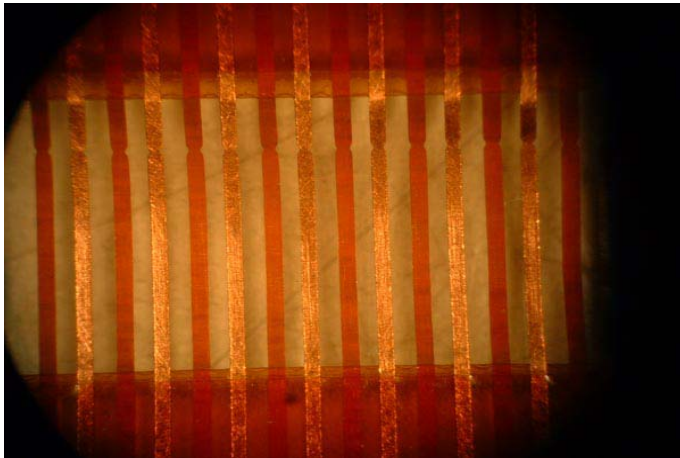


Photo courtesy of Micron Laser



Sig Jensen and the gang.

hot bar soldering or ultrasonic bonding. The picture above shows some tricky skiving done by Micron Laser - the flying leads are 0.5 ounce copper only 10 mils wide and 250 mils long. What makes this application more unique is that it is a two layer circuit - if you look closely you can see that adjacent traces are on different trace layers!

### On To The Land Of Emerald and Roses

On the day of the trip I woke up at an ungodly hour to catch the first flight from San Jose to Portland, Oregon. I knew it was going to be a good trip when I passed through the security screening area and didn't set off the metal detector. Upon landing in the City of Roses, I pointed the rental car South towards Hillsboro to visit Sig Jensen and Micron Laser. Sig has worked with lasers since way back in Tektronix days and has collected a wealth of knowledge for processing flex circuits, rigid boards and microwave boards. Most of his

business is drilling microvias in rigid boards, but more and more of his business is processing flex - microvias, cut outlines, skive coverfilm openings and flying leads. In addition to the Hillsboro facility he has a captive in-house shop at Merix in Forest Grove, OR and may open a non-captive facility in Southern California.

A few miles from Micron Laser is Electro Scientific Industries (ESI), a major laser manufacturer. Mike Jennings, Commercial Manager of Electronic



*Your Quality Flex Circuit Partner*

### Quick-turn Prototypes & Medium Production

- ◆ Mass Production Quality Flex Circuits
- ◆ Single, Double Sided, Multi-layer, and Rigid-Flex Designs
- ◆ Fine Line Trace / Space Capability  
0.0015" / 0.002" on 12 um Cu  
0.002" / 0.003" on 0.5 oz Cu
- ◆ Minimal Adhesive Squeeze-out
- ◆ Tight and Consistent Trace to Edge Registration With Burr-free Edges
- ◆ Approved and Endorsed by World's Largest Flex Circuit Manufacturers

*Customers Include:*  
 Flextronics  
 Hewlett Packard  
 Hitachi Global Storage  
 IBM  
 Innovex  
 Maxtor  
 Molex  
 Nitto Denko  
 Seagate  
 Sumitomo  
 StorageTek  
 Western Digital

**Altaflex, Inc.**  
 336 Martin Avenue,  
 Santa Clara, CA 95050  
 Ph: (408) 727-6614  
 Fax: (408) 988-8009  
[www.altaflex.com](http://www.altaflex.com)

**Quality, Service, and On-time Delivery**

Interconnect Group, gave me a close look at their lasers used for flex and pcb manufacturing. It turns out that ESI has an 85% share of laser equipment used in the flex circuit industry world-



Mike Jennings of ESI

Lasers made by ESI are used extensively across Asia to make high density rigid-flex circuits for the cell phone industry. These rigid-flex circuits use a polyimide base laminate with thin FR4 laminated on one or both sides. The lasers are then used to make microvias to connect the copper layers.

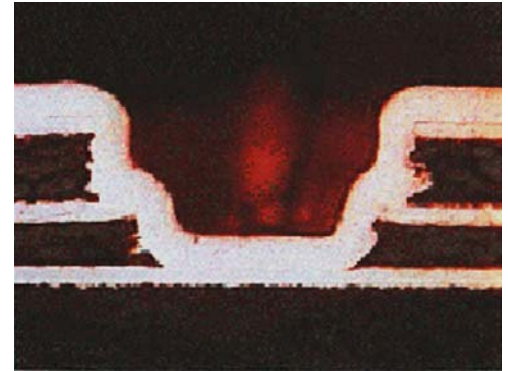
After the visit at ESI, Mike took me to a wonderful restaurant called Wildwood in the "Alphabet District" in North Portland. We swapped war stories way into the night, with Mike telling tales of riding motorcycles on six continents, from the Arctic Circle almost to Cape Horn. He even knew where Miners Mills was, the town in Pennsylvania where my great grandfather settled when he came from Poland in the 1890's. The pork chop I had was at least three inches thick and cooked to perfection, and the dark microbrewed beer was just heavenly. I got back to the hotel so stuffed.



Dilbert reprinted by permission of United Media Syndicate

The next morning I made a quick trip down I-5 to Wilsonville to meet Larry Burgess at LaserVia, a start up company that is developing some of the fastest microvia drills in the industry. Their key to speed is a patented process that uses a wide beam on a panel that has the via holes etched out of the copper. The etched copper acts as a mask to protect the rest of the circuit. This technique allows LaserVia to drill multi-depth blind microvias with one pass of the laser.

These multi-depth blind vias are stacked rather than staggered - all done in one step!



A three layer blind via made with LaserVia's patented process.

LaserVia sells laser drilling systems and provides laser services for flex and rigid manufacturers.

My two days in Oregon now over, my plan was to drive from Portland to Bremerton and take the ferry across the Puget Sound to Seattle. For the first part of the drive I took the backroads, winding along the Columbia River and across the very high

Back issues of The Flex Circuit News are available on our web page - [www.flexdude.com](http://www.flexdude.com)



Each edition of The Flex Circuit News contains a vintage Dilbert comic strip. Under our agreement with United Media Syndicate, we cannot include Dilbert in our archived editions. Please be sure to subscribe to The Flex Circuit News at [www.flexdude.com](http://www.flexdude.com).

Lewis and Clark Bridge at Longview. Then I crossed over to Interstate 5 and drove North. A few miles outside of Tacoma I was surprised to see the highway go over this big suspension bridge - the Tacoma Narrows bridge! This is the bridge we've all seen in science class fall down due to vibration harmonics caused by wind. I guess they got it right when they rebuilt it because the bridge survived my crossing. I arrived in Bremerton early in the evening, driving past the rows of great gray warships at Bremerton Naval Shipyard.



Approaching Seattle at dawn.

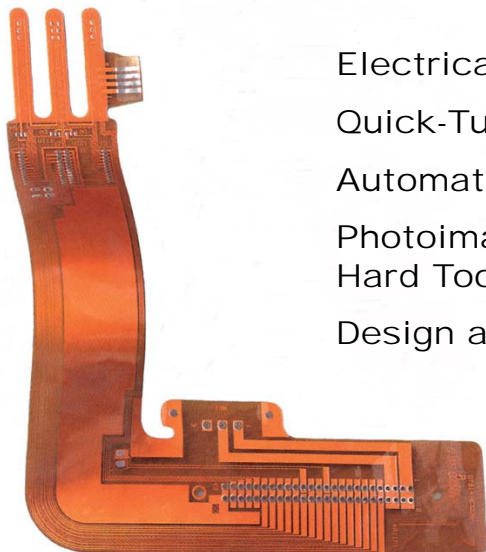
### Sunrise over Seattle

Next morning there was already a line of cars when I pulled up to the ferry building at 4:45 and by 5:15 the boat pulled out into the darkness. The warships were not yet visible, but bright yellow signs in the water proclaimed "Government Property - Stay 300 feet away - Violators will be prosecuted." The morning dawned as we crossed Puget Sound and the early morning light revealed Mount Rainier peeking out of the clouds and the skyline of The Emerald City. What a way to go work!

After an hour on the water, the ferry pulled up to the dock in downtown Seattle and all the cars made their way past the stadiums for the Seahawks and Mariners. After winding my way through the port area I finally found Interstate 90 heading East towards a little town called Snoqualmie - home of MicroConnex. Traffic moved well despite driving straight into the rising sun and I arrived at Snoqualmie about seven o'clock - I had beat the rush hour traffic, but now I was two hours early for my appointment.



## Excellence in the Design, Manufacture & Assembly of Flexible Circuits!



- Electrical Testing and Engineering Analysis
- Quick-Turn Prototypes or Production Quantities
- Automated Assembly
- Photoimageable Coverlay - Eliminates Expensive Hard Tooling and Lead Time
- Design and Turnkey Services Available

### GC Aero Flexible Circuitry

3165 Fujita Street Torrance, CA 90505  
310-539-7600 Fax 326-7903 Modem 539-6784

[www.gcaero.com](http://www.gcaero.com)



After locating MicroConnex in the business park I drove out to see Snoqualmie Falls - a 270 feet high waterfall which is the sight of the first hydro-electric power plant in the country. A couple of quick pictures and back into town to find a place to eat. I found a great little place called Eddy's, a



classic old-style eatery that had just what I wanted: biscuits and sausage gravy. Powered by this high-octane breakfast I took a quick look at the antique train and logging equipment that the town has on display, and made my way back to MicroConnex.



MicroConnex - in beautiful Snoqualmie.

micron traces and spaces using laser direct write techniques, such as laser imaging of the photoresist, laser removal of the photoresist, or even using the laser to remove the unwanted copper and create the conductor pattern. Pretty cool stuff!

Weaving my way through early rush-hour traffic to Sea-Tac airport, I was lucky enough to catch an early flight. I bought some smoked salmon at the gift shop and settled in for the ride home, resolved not to wait another twenty-five years to come back.

MicroConnex is a high-end flex proto shop. They began as a research firm developing ultrasound transducers, but quickly found that the kind of flex circuits they needed were not available, so they set out to make them themselves. They found the market for high density flex circuits was much bigger than the market for transducers.

The list of their in-house capabilities is impressive, including sputtering and laser processing. They routinely build fine-line flex circuits with 12 layers and have built a small planar transformer with 54 layers. They also build circuits with geometries down to 50 micron pitch (one mil lines and spaces). Their laser guru Ben Ross makes their ESI 5200 sing, making microvias, cutting outlines and skiving flying leads. Because the capacity of the laser is much greater than their small shop needs, MicroConnex also provides laser services to other flex proto shops.

Since my visit MicroConnex has purchased the latest whiz-bang laser from ESI - the 5330. According to Art Kuller, president of MicroConnex, they are using it to make flex circuits with 10

ESI  
 13900 NW Science Park Drive  
 Portland, Oregon 97229  
 503-641-4141  
 fax 503-671-5571  
[www.esi.com](http://www.esi.com) 

LaserVia Corporation  
 9755 SW Commerce Circle, Suite B-4  
 Wilsonville, OR  
 503-936-7518  
 fax 503-570-4239  
[www.laservia.com](http://www.laservia.com) 

MicroConnex  
 34935 SE Douglas Street Suite 200  
 Snoqualmie, Wa., 98065  
 425-396-5707  
 fax 425-396-5861  
[www.microconnex.com](http://www.microconnex.com) 


Micron Laser Technology Inc.  
 22750 NW Wagon Way, Suite A Hillsboro, Oregon  
 97124  
 503-439-9000  
 fax 503-439-3365  
[www.micronlaser.com](http://www.micronlaser.com) 

## More Cool Stuff...

Need A Laugh?  
Go To Homestarrunner.com



Homestar

These days we can all use a laugh and I find myself laughing hysterically at the stuff on [www.homestarrunner.com](http://www.homestarrunner.com). 

**Note - The site is entirely flash cartoons, so if your computer doesn't have a sound card and speakers wait until you get home!**

On the web since 2001, Homestar, Strong Bad, Bubs, The Cheat and the other citizens of FreeCountry, USA are the creation of Matt and Mike Chapman of Atlanta. The site is a great combination of simple animation with some of the sharpest satire available. There is so much stuff on the website you can explore for hours.



Strong Bad

Favorite stuff: Strong Bad e-mail, where Strong Bad answers e-mail from fans. Check out the one about the dragon.

<http://www.homestarrunner.com/sbemail58.html> 

Teen Girl Squad - Cartoons also written by Strong Bad. In the Toons section.

<http://www.homestarrunner.com/tgsmenu.html> 

Legal stuff: Homestar and Strong Bad are the copyrighted property of Homestarrunner.com, so hands off!

Did someone forward  
The Flex Circuit News to you?

Subscribe today  
and have it sent directly to you!

[www.flexdude.com](http://www.flexdude.com) 

## Altaflex adds ESI Lasers

Speaking of lasers, Altaflex in Santa Clara has just added **two** ESI 5200 lasers that they are using extensively for microvia drilling, cutting coverfilm material and cutting circuit outlines. Big kudos to Mike Jennings and the guys at ESI for helping Altaflex get up and running.

[www.altaflex.com/hdi.htm](http://www.altaflex.com/hdi.htm) 

AutoCAD-to-Altlegro  
Conversions are a  
Specialty for  
Flex Circuit Design Company

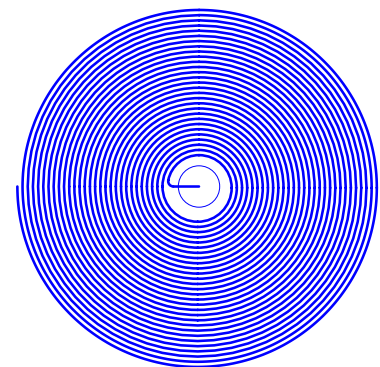


(Warning - shameless plug ahead!)

A while back we added Cadence Allegro to our CAD arsenal for complex rigid-flex designs as well as the occasional rigid board design we see. Now that we've worked with Allegro for a while, we've received an added benefit - an expertise in going back and forth between Allegro and AutoCAD.

Normally for flex circuit designs we use AutoCAD along with very expensive, double-super-secret software that makes AutoCAD do pcb design work and create gerber files. AutoCAD is perfect for creating the complex shapes and angles that many flex circuits need.

Allegro, for all it's power, is very poor at complex trace routing, such as a spiral for an coil or compound curves around a hole.



Spiral trace created in AutoCAD  
and imported into Allegro.

Now, we can create complex trace routing in AutoCAD and then import it into Allegro. We can also do translations for customers that have old flex circuit designs in AutoCAD or gerber but need them in Allegro, adding all the design intelligence necessary to make Allegro happy!