

Microelectronics Packaging & Test Engineering Council



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**Welcome to MEPTEC**

MEPTEC (Microelectronics Packaging and Test Engineering Council) is a trade association of semiconductor suppliers, manufacturers, and vendors concerned exclusively with packaging, assembly, and test. Since its inception over 30 years ago, MEPTEC has provided a forum for semiconductor packaging and test professionals to learn and exchange ideas that relate to packaging, assembly, and test. Through our monthly luncheons, symposiums, and an Advisory Board consisting of individuals from all segments of the semiconductor industry, MEPTEC continuously strives to improve and elevate the roles of assembly and test professionals in the industry.

**MEMBER SERVICES**  
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**UPCOMING MEPTEC EVENTS**

MEPTEC 2017  
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# MEPTEC Report

A Quarterly Publication of the Microelectronics Packaging & Test Engineering Council Volume 21, Number 2

**FAILURE ANALYSIS**  
A Tool for Developing New MEMS Sensors  
page 24

**2017 Semiconductor Industry Equipment and Materials Outlook**  
page 14

**MEPTEC MEMBER COMPANY PROFILE**  
Located in Itasca, IL, just outside of Chicago, Kester's center of excellence houses their global manufacturing for many of their products as well as centralized R & D staff and application equipment, technical support labs and product management capabilities.  
page 16

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**23** Are trade secrets a better alternative to patents?

**30** Advanced packaging technologies get reliability boost from NCF material.

**34** The demand for external consultants is growing as evidenced by reports from Technova Consulting and others.

A SPECIAL TWO-DAY TECHNICAL CONFERENCE

2013 MEPTEC  
**MEDICAL TECHNOLOGY CONFERENCE**  
Global Momentum in the Medical Industry—Convergence of Electronics, Biology and Health

San Jose, CA  
San Jose, CA  
San Jose, CA

**9.17.13**

A SPECIAL ONE-DAY TECHNICAL SYMPOSIUM

2013 MEPTEC  
**SEMICONDUCTOR ROADMAPS SYMPOSIUM**  
A Collaborative Update from Standards Bodies, Industry Groups, and the Entire Supply Chain

San Jose, CA  
San Jose, CA

**9.24.13**

A SPECIAL ONE-DAY TECHNICAL SYMPOSIUM

Twelfth Annual MEPTEC  
**MEMS TECHNOLOGY SYMPOSIUM**  
ADVANCES IN MEMS—Foundations of Design, Process, Packaging and Test

San Jose, CA  
San Jose, CA

**5.22.14**

A SPECIAL ONE-DAY TECHNICAL SYMPOSIUM

2014 MEPTEC  
**SEMICONDUCTOR PACKAGING TECHNOLOGY SYMPOSIUM**  
Pushing the Limits in Packaging Design and Manufacturing

San Jose, CA  
San Jose, CA

**10.23.14**

A SPECIAL ONE-DAY TECHNICAL SYMPOSIUM

14th ANNUAL MEPTEC  
**MEMS TECHNOLOGY SYMPOSIUM**  
Enabling the Internet of Things: Foundations of MEMS Process, Design, Packaging & Test

San Jose, CA  
San Jose, CA

**5/20/15**

# WELCOME

A SPECIAL TWO-DAY TECHNICAL CONFERENCE

2013 MEPTEC  
**MEDICAL TECHNOLOGY CONFERENCE**

*Global Momentum in the Medical Industry—Convergence of Electronics, Biology and Health*

ASU **sbhse**  
Arizona State University School of Biological and Health Systems Engineering

Tuesday, September 17th  
Wednesday, September 18th

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gedwards@mepotec.org

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MEPTEC (Microelectronics Packaging and Test Engineering Council) is a trade association of semiconductor companies and professionals involved in the manufacturing, packaging, assembling and testing of integrated circuits.

Since its inception 40 years ago, MEPTEC has provided a forum for the semiconductor industry to learn and exchange ideas through our monthly luncheons, conferences, and our quarterly publications, the MEPTEC Report. With the help support of an Advisory Board consisting of individuals from all segments of the industry, MEPTEC has, over the years, kept current not just with with not just semiconductor industry developments, but has expanded its scope to cover relevant industry segments such as MEMS and medical electronics.



The MEPTEC Report is published four times per year as a service to MEPTEC members and supporters. The full color publication features articles on cutting edge technology, guest editorials, industry developments, and other news applicable to major issues surrounding the world of semiconductor assembly and test.

Our primary goal has been to make the MEPTEC Report a marketing tool for MEPTEC member companies. Priority coverage is given to member companies' products, services, and technology development. Advertising in the MEPTEC Report is very cost effective when compared to other trade journals, and reaches a very targeted audience of loyal readers. With the addition of a digital edition the MEPTEC Report reaches an ever increasing audience.



### MATERIALS

**3D Architectures for Semiconductor Integration and Packaging**

**3D ASIP December 11-13, 2013, Burlingame, California**

The Technology and Market Landscape for Device and Systems Integration and Interconnect

This conference provides a unique perspective of the emerging business aspects of the emerging commercial opportunities of 3D integration and packaging—encompassing design, business, research, development, and production. The speakers address the information needed to plan and execute successful 3D architectures.

For more information visit: [www.3dasiip.org](http://www.3dasiip.org)

### OPINION

#### Do MEMS Work For You?

Mark Spector, President and Managing Director, MEMS Microsystems Ltd.

MEMS are becoming more and more important in the consumer electronics market. The MEMS market is growing rapidly and is expected to reach \$10 billion by 2015. This growth is driven by the increasing use of MEMS in a wide range of applications, from automotive to healthcare.

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### Amkor Technology

## BIG FIVE PACKAGES

Packaging Solutions for Smartphones and Tablets

- Wafer Level Chip Scale Packages
- Laminate-Based Advanced SIP
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- Low-Cost Flip Chip
- MEMS

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Contact: [gedwards@meptec.org](mailto:gedwards@meptec.org)

Print copies of the MEPTEC Report are distributed directly to all MEPTEC members. Additionally, thousands of bonus copies are distributed at major industry events throughout the year. The MEPTEC Report is also available as a digital publication distributed at no charge through the MEPTEC website.

#### Bonus Event Distribution

- All MEPTEC Symposiums and Luncheons
- APEX Expo & Conference
- ECTC / Electronic Components and Technology Conference
- IMAPS Device Packaging Conference & Exhibition
- IMAPS International Symposium on Microelectronics
- IWLPC / International Wafer Level Packaging Conference
- RTI 3D Architecture Conference
- SEMICON West
- SMTA International Exposition and Conference
- SMTA Pan Pacific Microelectronics Symposium & Exhibition

## MEPTEC Report Advertising Rates and Deadlines

Rates are effective with advertising placed in the MEPTEC Report beginning Spring 2018 Issue.

<b>Four Color Rates</b> (per insertion)	Standard Rate	<i>Discounted Member Rate</i>
2 page Technitorial Spread	\$2750	<b>\$2500</b>
Full page	\$1815	<b>\$1695</b>
2/3 vertical	\$1395	<b>\$1245</b>
1/2 vertical or horizontal	\$1180	<b>\$1070</b>
1/3 vertical or square	\$1025	<b>\$920</b>
1/4 vertical	\$885	<b>\$770</b>
1/6 vertical	\$350	<b>\$250</b>

<b>Black &amp; White Rates</b> (per insertion)	Standard Rate	<i>Discounted Member Rate</i>
Full page	\$1180	<b>\$1070</b>
2/3 vertical	\$925	<b>\$820</b>
1/2 vertical or horizontal	\$745	<b>\$645</b>
1/3 vertical or square	\$595	<b>\$495</b>
1/4 vertical	\$450	<b>\$345</b>

### Additional Discounts

A 15% discount will be allowed on pre-paid advertising for four issues or more.

### Bleed Charges

No charge for bleed on full-page, 2/3, 1/2 and 1/3 page ads. Bleed not available on 1/4 and 1/6 page ads.

### Special Positions

Special positions are available at a premium of 10% of the space rate and include inside front cover, inside back cover, and back cover.

<b>Deadlines</b>		
Spring 2018 Issue	Ad space close: 2/9	Materials due: 2/16
Summer 2018 Issue	Ad space close: 5/11	Materials due: 5/18
Fall 2018 Issue	Ad space close: 8/10	Materials due: 8/17
Winter 2018 Issue	Ad space close: 11/9	Materials due: 11/16

Contact: [gedwards@meptec.org](mailto:gedwards@meptec.org)

# MEPTEC Report Ad Specifications

<p>Full Page Non Bleed 7.2 x 9.5</p>	<p><b>TECHNOLOGY</b></p> <p>To those of us in the industry, we don't give a second thought if I send you a letter that says "I'm not interested in your product." But in the past few years, I have noticed a significant change in the way that our customers are responding to our products. It's not just the quality of our products that has improved, but the way that our customers are responding to our products. They are now more interested in our products than ever before. This is a great sign for us, and it shows that our customers are recognizing the value of our products. We are proud of our products, and we are confident that they will continue to be a success for many years to come.</p>
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<p>2/3 Page Vertical 4.6 x 9.5</p>	<p><b>ANALYSIS</b></p> <p>It's not just the quality of our products that has improved, but the way that our customers are responding to our products. They are now more interested in our products than ever before. This is a great sign for us, and it shows that our customers are recognizing the value of our products. We are proud of our products, and we are confident that they will continue to be a success for many years to come.</p>	<p><b>TECHNOLOGY</b></p> <p>To those of us in the industry, we don't give a second thought if I send you a letter that says "I'm not interested in your product." But in the past few years, I have noticed a significant change in the way that our customers are responding to our products. It's not just the quality of our products that has improved, but the way that our customers are responding to our products. They are now more interested in our products than ever before. This is a great sign for us, and it shows that our customers are recognizing the value of our products. We are proud of our products, and we are confident that they will continue to be a success for many years to come.</p>
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<p>1/4 Page 3.45 x 4.6</p>	<p><b>TECHNOLOGY</b></p> <p>To those of us in the industry, we don't give a second thought if I send you a letter that says "I'm not interested in your product." But in the past few years, I have noticed a significant change in the way that our customers are responding to our products. It's not just the quality of our products that has improved, but the way that our customers are responding to our products. They are now more interested in our products than ever before. This is a great sign for us, and it shows that our customers are recognizing the value of our products. We are proud of our products, and we are confident that they will continue to be a success for many years to come.</p>
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<p>1/2 Page Vertical 3.45 x 9.5</p>	<p><b>ANALYSIS</b></p> <p>It's not just the quality of our products that has improved, but the way that our customers are responding to our products. They are now more interested in our products than ever before. This is a great sign for us, and it shows that our customers are recognizing the value of our products. We are proud of our products, and we are confident that they will continue to be a success for many years to come.</p>	<p><b>TECHNOLOGY</b></p> <p>To those of us in the industry, we don't give a second thought if I send you a letter that says "I'm not interested in your product." But in the past few years, I have noticed a significant change in the way that our customers are responding to our products. It's not just the quality of our products that has improved, but the way that our customers are responding to our products. They are now more interested in our products than ever before. This is a great sign for us, and it shows that our customers are recognizing the value of our products. We are proud of our products, and we are confident that they will continue to be a success for many years to come.</p>
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Ad Size	Non-Bleed	Bleed	Trim
Full page	7.20 x 9.50 in. (183 x 241 mm)	8.25 x 10.75 in. (210 x 273 mm)	8.00 x 10.50 in. (203 x 267 mm)
2/3 vertical	4.60 x 9.50 in. (117 x 241 mm)	5.25 x 10.75 in. (133 x 273 mm)	5.00 x 10.50 in. (127 x 267 mm)
1/2 vertical	3.45 x 9.50 in. (88 x 241 mm)	4.10 x 10.75 in. (104 x 273 mm)	3.85 x 10.50 in. (98 x 267 mm)
1/2 horizontal	7.20 x 4.60 in. (183 x 117 mm)	8.25 x 5.35 in. (210 x 136 mm)	8.00 x 5.10 in. (203 x 130 mm)
1/3 vertical	2.25 x 9.50 in. (57 x 241 mm)	2.90 x 10.75 in. (74 x 273 mm)	2.65 x 10.50 in. (67 x 267 mm)
1/3 square	4.65 x 4.60 in. (118 x 117 mm)	N/A	N/A
1/4 vertical	3.45 x 4.60 in. (88 x 117 mm)	N/A	N/A
1/6 vertical	2.25 x 4.60 in. (57 x 117 mm)	N/A	N/A

Contact: [gedwards@mepotec.org](mailto:gedwards@mepotec.org)





**MEPTEC Report** SUMMER 2017  
A Quarterly Publication of the Microelectronics Packaging & Test Engineering Council Volume 21, Number 2

**FAIL**  
A Tool for Developing  
2017 S  
Equipment c

**MEMBER COMP**  
Located in Itasca, IL, just  
dinter of excellence hou  
for many of their produ  
staff and application se  
and product managemen  
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**INSIDE THIS ISSUE**

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sees EPC  
evolution  
at the pack-  
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shows a better  
return on  
investment

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the fab

**SMART MICROSYSTEMS**  
Your Microelectronic Package Assembly Solution for MEMS Sensors

### Considerations for an Effective MEMS Die Attach Strategy

WILLIAM RYAN  
SMART MICROSYSTEMS LLC

**THE ATTACH METHOD IS IN EVERY** very fundamental to MEMS product design. Unfortunately, during the early product development and design phase of a new MEMS product, very little is known about the die attach strategy. Given enough resources, it is possible to create a die attach method that will provide the necessary strength, bonding, and adhesion. The focus of this article will be on the most practical methods for die attach. In the realm of adhesive die attach there are three major properties that can drastically affect the product function or production process. These properties include adhesion, rigidity, viscosity or dispense, working life, cure method, and cure temperature. Each of these parameters (as well as some not mentioned here) need to be carefully considered.

**Adhesion**  
Fundamentally all die attach methods must serve as a permanent bond to the package. Many of the MEMS die found in today's systems are based on the attach method to provide a proper bond and avoid the lead path. If the die attach method is also a lead wire, then it must also have adequate adhesion to form a proper and avoid the thermal generation of the MEMS die. Die that require lead wire are typically precision systems. In addition to using a lead wire the attach material is also a pressure seal. In these cases, adhesion to the die and the package is vital. To use lead wire attach a clear resin can be used. This resin will automatically clear the air off of the package, remove the flux, and will provide the desired bond. It is important that the clear resin cures to exactly the thickness and adhesion value for the geometry of the part. It is also important to consider the thermal expansion of the resin. This is a factor that can be an important factor in the design. The resin must be able to expand on the die or on the package. If the resin is too rigid then there is a real possibility that stress on the outside package will affect the MEMS die output. This is known as a potential stress induced effect. In some cases, if the bond is not stiff enough, the opposite can occur. The MEMS die will experience movement in the package during presentation, vibration, or mechanical shock. This will affect the life of the sensor and contribute to possible offset shift. It is important to select the proper adhesive for the application and the life of the sensor.

**Dispense and Working Life**  
Some of the electronic adhesives used in the die attach process are dispensed in place or cure in situ. The viscosity and working life of an adhesive are critical material properties that can have a significant impact on the assembly process. The amount of material required to attach the die and form a seal is governed by the geometry of the part and the viscosity of the adhesive. If

**Figure 1. Show transportation for assembling die attach method.**

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Your Microelectronic Package Assembly Solution for MEMS Sensors

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- Wire Bonding
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- Environmental Life Test

**SMART MICROSYSTEMS**

Promote your products or services with this unique advertising opportunity. Each MEPTEC Report issue will contain a limited number of “technitorial” features which will highlight different aspects of technology relevant to assembly, packaging and test. The feature will include a right-hand placed full page, four-color advertisement, and a facing full page write-up. Priced at the low cost of \$2,500.00, it is essentially two full pages of advertising for the price of 1-1/2 pages.

### What is a Technitorial?

A technitorial is a full page write-up provided by the advertising company that is a complementary technical piece to the full page advertisement, describing the company’s products or services, non-commercial in nature. It will educate and inform the reader, yet will be subtly slanted towards the company’s technology by being placed next to the company’s full page advertisement. The article will not mention the advertising company’s name, but a by-line and contact information will be allowed.

Contact Gina Edwards at [gedwards@meptec.org](mailto:gedwards@meptec.org) for availability and to place your order.

# MEPTEC Report 1/6 Page Ad Artwork Production

Promote your products or services with a low cost 1/6 page four-color ad space in the MEPTEC Report. Rate includes ad artwork, if needed, created using images provided by you (photo and/or company logo) and your text.

Ad Rates (per insertion)	Standard Rate	Discounted Member Rate
1/6 page Ad	\$350	\$250

### Additional Discounts

A 15% discount will be allowed on pre-paid advertising for four issues or more.

### 1/6 Page Ad Specifications

1/6 Page Ad artwork can be produced at no additional charge from materials supplied by advertisers. Advertiser should provide one four-color image (either photo or company logo) and one text file. Acceptable electronic formats are as follows: Photo image or logo files should be provided as eps, tiff, or jpeg files. Images should be at least 300 dpi at the final desired print size for best reproduction quality. Ad text should be approximately 75 words (or less) and submitted as a Word document. Please include your company website URL for inclusion at bottom of ad.

	<h3>COLUMN</h3> <h4>COUPLING &amp; CROSSTALK</h4> <p>By a Fellow</p> <p>ELECTRONIC COUPLING OF THE transfer of energy from one circuit to another is a common occurrence. ...</p> <h4>Measuring Up</h4> <p>▶ FAST TO TURN ON, FAST TO TURN OFF, you should know your test equipment's capabilities ...</p>	<p>Most successful MEMS sensors are of body application (typical by automotive and aerospace applications). ...</p> <p>The primary challenge in these devices is to control the thermal drift that occurs as a result of changes in the thermal environment. ...</p> <p>MEMS sensors are used in a wide range of applications, from automotive to aerospace. ...</p>	
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Contact: [gedwards@meptec.org](mailto:gedwards@meptec.org)

MEPTEC banner ads are a low cost way to gain exposure for your company while stretching your advertising dollars. MEPTEC Banner ads start as low as \$95.00 per month for a single unit banner, up \$380.00 per month for a quad banner, when purchased on a 12 month contract. All banners appear in the right-hand column on every page of the MEPTEC website and are positioned on a first-come first-served basis.



### Banner Ad Sizes

Single Banner: 120 pixels (w) x 90 pixels (h)

Double Banner: 120 pixels (w) x 180 pixels (h)

Triple Banner: 120 pixels (w) x 270 pixels (h)

Quad Banner: 120 pixels (w) x 360 pixels (h)

### Banner Ad Specifications

Accepted in GIF format only, animation permitted. 15K maximum file size for Single unit banner, 30K for Double, 45K for Triple, and 60K maximum file size for Quad banner. Please provide the URL address for the specific page that you would like to have your ad linked.

Banner Prices	MEPTEC Member Rate (cost per month)				Non-Member Rate (cost per month)			
	Single	Double	Triple	Quad	Single	Double	Triple	Quad
1 Month	\$125	\$250	\$375	\$500	\$150	\$300	\$450	\$600
3 Months	115	230	345	460	140	280	420	560
6 Months	105	210	315	420	130	260	390	520
12 Months	95	190	285	380	120	240	360	480

Contact Gina Edwards at [gedwards@meptec.org](mailto:gedwards@meptec.org) to place your order.

A limited number of MEPTEC Monthly Update Email Banner Ads are now available to MEPTEC Members only. These banner ads cost \$45.00 per month for a single unit banner, or \$450.00 for 12 months when purchased on a 12 month contract. All banners appear in the left-hand column and are positioned on a first-come first-served basis. A maximum of 10 banners will appear on each Monthly Update email. Current monthly distribution numbers approximately 4500 recipients.

Banner Ad Size

120 pixels (w) x 90 pixels (h)



### Banner Ad Specifications

Accepted in GIF format only, animation permitted. 15K maximum file size for single unit banner. Please provide the URL address for the specific page that you would like to have your ad linked.

Banner Prices	Available to MEPTEC Members Only Single Unit Banner
1 Month	\$45.00 per month
12 Months	\$37.50 per month

Contact Gina Edwards at [gedwards@meptec.org](mailto:gedwards@meptec.org) to place your order.

MEPTEC offers a variety of event sponsorship opportunities for its technical symposiums. Event sponsorship provides a valuable opportunity to promote your company brand and product or service message to attendees while supporting your business development and positioning goals.

Typical Sponsorship Benefits include:

**Platinum Sponsor: \$3,250 - 3 available per event**

- Company name & logo listed as Platinum Sponsor on all promotional materials, including email and web promotions
- Full-page black & white ad in event proceedings
- 3 free admissions to symposium
- 1 tabletop exhibit display at event
- Featured as Platinum Sponsor in symposium proceedings
- 1 CD of symposium proceedings
- Company logo/description displayed on video screen at beginning of event
- Signage recognition at event
- Exposure in semiconductor industry trade magazines (deadline restrictions)
- Discount on future MEPTEC Report 1/2 page or larger, 4-color ad

**Gold Sponsor: \$2,500 – 5 available per event**

- Company name & logo listed as Sponsor on all promotional materials, including email and web promotions
- Full-page black & white ad in event proceedings
- 2 free admissions to symposium
- 1 tabletop exhibit display at event
- Featured as Gold Sponsor in symposium proceedings
- 1 CD of symposium proceedings
- Company logo/description displayed on video screen at beginning of event
- Signage recognition at event
- Exposure in semiconductor industry trade magazines (deadline restrictions)
- Discount on future MEPTEC Report 1/2 page or larger, 4-color ad



**Silver Sponsor: \$1,250 – 10 available per event**

- Company name & logo listed as Sponsor on all promotional materials, including email and web promotions
- 1/2 page black & white ad in event proceedings
- 1 free admission to symposium
- Featured as Sponsor in symposium proceedings
- 1 CD of symposium Proceedings
- Company logo/description displayed on video screen at beginning of event
- Signage recognition at event
- Exposure in semiconductor industry trade magazines (deadline restrictions)

*Note: Sponsorship pricing and benefits may vary from event to event. For specific sponsorship details and more information contact Gina Edwards at [ggedwards@meptec.org](mailto:ggedwards@meptec.org).*

## MEPTEC Event Exhibiting Opportunities

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MEPTEC offers table top exhibit opportunities at its technical symposiums throughout the year. A limited number of table-top exhibit spaces are available on a first-come, first-served basis. Each draped table is 2-6 x 6-0. The cost includes a table and chairs, a complimentary table top sign, company description in the Symposium proceedings, and one complimentary admission to the symposium. You may use your table to display literature, parts, small pieces of equipment, table top display signs, etc. A table top sign will be provided, but you may also wish to display a banner or some other appropriate type of sign on the front or top of the table.

Visit the MEPTEC website for currently scheduled events.

For more information contact Gina Edwards at [gedwards@meptec.org](mailto:gedwards@meptec.org).