

Technical Considerations

for Prehospital 12 Lead Transmission



Raymond L. Fowler, M.D., FACEP

**Co-Principal Investigator
National Institutes of Health
Resuscitation Outcomes Consortium**

**Joint Investigator
National Heart, Lung, and Blood Institute
IMMEDIATE Trial**

**Chief of Medical Operations
Dallas Area BioTel System**

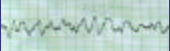
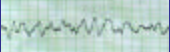
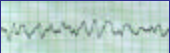
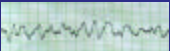
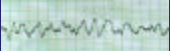
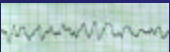
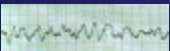
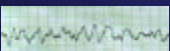
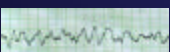
**Co-Chief in the Section on
EMS, Disaster Medicine, and Homeland Security
Southwestern Medical Center**

A sunset scene with several parachutes and silhouettes of people descending. The sky is a mix of orange, yellow, and red, with the sun low on the horizon. Multiple parachutes are visible, some fully deployed and others partially. Silhouettes of people are seen against the bright background, some appearing to be in the process of landing or descending. The overall mood is dramatic and serene.

www.uts.w.w.s

www.rayfowler.com

Objectives

-  **Definitions and Purposes
of Real-time ECG Transmission**
-  **Methods of transmission**
-  **Equipment required for transmission**
-  **Challenges confronting ECG
transmission and reception**
-  **Models of excellence**
-  **Examples of difficulty in transmission**
-  **Case presentation**
-  **Summary**
-  **Questions**

The BioTel Numbers

- ◆ 1300+ Fire Medics with Central On-line Medical Command
- ◆ 15 Cities
- ◆ ~ 220,000 Responses
- ◆ ~ 100,000 transports
- ◆ ~ 120,000 non-transports
- ◆ ~ 1,700+ Cardiac arrests
- ◆ ~ 5,000 suspected ACS patients



The Future of EMS Appears Dimly Charted



*“Sailing ships are safe in harbors,
but that’s not what
sailing ships are for...”*

The emerging of
a subspecialty:



The Critical Point

✦ EMS is Medicine



The Evolving Scope of EMS

- ✦ They used to call us for a ride
- ✦ Now they're calling us for an exam, to get checked out, to receive some services, and they'll decide if they want further evaluation and care or not
- ✦ How do we deal with this evolution?



BP = 88/55

P = 160

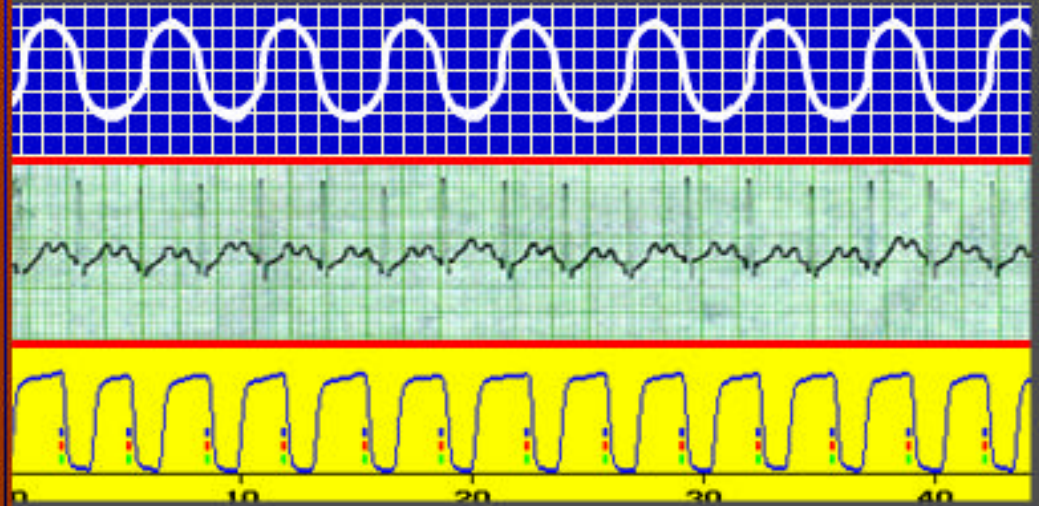
Resp = 36

TV = 800

Glu = 425

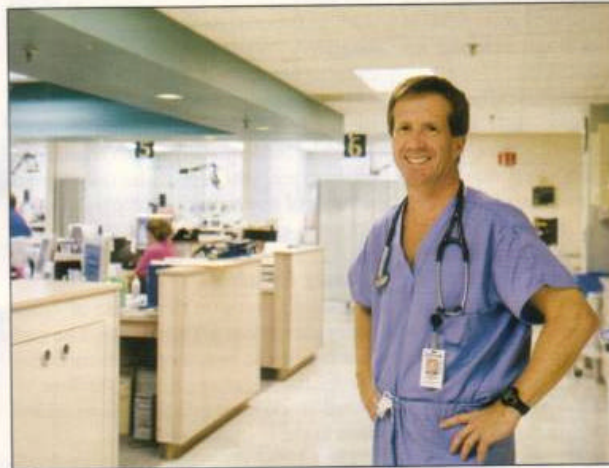
Hgb = 9

*Medics are becoming
“Out of Hospital
Intensivists” and
EMS Medicine may
become a subspecialty*



ACEP NEWS

AN OFFICIAL PUBLICATION OF THE AMERICAN COLLEGE OF E



COURTESY: PAUL DAVIS/RIDGEVIEW MEDICAL CENTER FOUNDATION

No deaths occurred during transfer of 746 STEMI patients for percutaneous coronary intervention, said Dr. David M. Larson.

Protocol Makes STEMI Patient Transfer Safer

BY FRAN LOWRY
Elsevier Global Medical News

NEW ORLEANS — Implementation of an organized transfer protocol has yielded evidence that moving high-risk ST-elevation myocardial infarction patients—even those who are in cardiogenic shock—from community hospitals for percutaneous coronary intervention can be done safely.

Transferring these patients for PCI essential most of the time, Dr. David M. Larson, of the Ridgeview Medical Center, Waconia, Minn., and the Minneapolis Heart Institute, said at the Scientific Assembly of the American College of Emergency Physicians.

No deaths occurred during transfer of 746 consecutive STEMI patients for PCI using the Level 1 Heart Attack program, a standardized transfer protocol

IOM's Four- Seeks Em Care Crisis

Single-agency idea get

BY GLENDA
FAUNTLEROY
Elsevier Global Medical News

WASHINGTON — Although the federal government should play a key role in repairing the nation's emergency health care system, much of the job of reform may fall on the emergency care community itself, according to health experts, lawmakers, and federal officials who met at the Institute of Medicine's final workshop on the future of emergency care.

Following previous regional workshops in Salt Lake City, Chicago, and New Orleans, the IOM conducted its fourth stop on a nationwide tour to disseminate the findings from this summer's three landmark reports on the state of emergency care (*ACEP News*, July 2006, p. 1).

"As we went around the country, we heard that this (IOM) report may be the most

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Name: CLEMENTS, JULIA 12-Lead 1 HR 169bpm Abnormal ECG **Unconfirmed**
ID: 101406124512 10/14/2006 12:48:15 PM wide QRS tachycardia
Patient ID: PR 0.000s QRS 0.188s Left bundle branch block
Incident ID: 615292 QT/QTc: 0.350s/0.586s
Age: 65 Sex: F P-QRS-T Axis: 90 118

Definitions

Real-time ECG field transmission is the electronic sending of an electrical recording of a cardiac event to a hospital-based facility at the time of acquisition of the recording

x1.0 .05-150Hz 25mm/sec

Medtronic, Inc. Comments:

A-9 000 3011371-124 LP1231254529

Name: 12-Lead 1 HR 77bpm | Abnormal ECG **Unconfirmed**
ID: 101406182959 10/14/2006
Patient ID: PR 0.126s
Incident ID: 615305 QT/QTc: lateral ischemia
Age: 43 Sex: F P-QRS-T Axes: 30 4 -19

Purposes

Earlier activation of ER & cath lab

Assist in strip interpretation

Real-time quality control

The background of the slide is a red grid with a black ECG waveform. The waveform shows a regular rhythm with distinct P waves, QRS complexes, and T waves. The grid lines are spaced at regular intervals, typical of medical monitoring equipment.

Field Transmission Methods

FAX and Receiving Station

12:48:56 ||

Email attachment

**Ischemia management over
Internet Protocol (I.P.)**

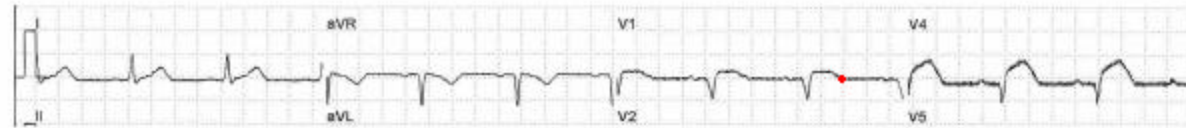
12:49:11 ||

Many monitors have only the capability for an “RJ-11” interface (phone line connection) which allows the sending of the 12 lead as a FAX connection



**This requires the ability to get a “dial tone”
in earlier monitors**





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Send 12 Lead ECG Fax by Digital Cell Phone
also works with regular FAX machines

- Works with analog fax machines
- Provides LaserJet quality faxes
- works over digital cellular
- FDA 510k Clearance

For more information call
800-854-8865

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TelEnable™ Technology
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EMS-Enable™

Orange Box Portable Unit



- Easy to use
- Works on-site and in moving ambulances
- Compatible with Zoll, Welch Allyn, Medtronic, and most other 12-lead fax enabled monitors
- Faxes transmitted **FREE** of transmission and artifact error
- Battery powered rechargeable NiMH
- Rugged Pelican case
- Data encrypted during transmission to ensure patient privacy
- Dimensions: 8.5" w x 6.5" d x 3.75" h
- 1-year Factory Warranty
- **FDA 510K Cleared**
- Available with optional embedded digital phone

FDM Fixed Installation



- Easy to use
- Works in moving ambulances
- Compatible with Zoll, Welch Allyn, Medtronic, and most other 12-lead fax enabled monitors
- Faxes transmitted **FREE** of transmission and artifact error
- Data encrypted during transmission to ensure patient privacy
- Rugged extruded aluminum enclosure
- Runs on standard 12v DC power
- Dimensions: 5" w x 5" d x 2" h
- 1-year Factory warranty
- **FDA 510K Cleared**
- Available with optional embedded digital phone

The “Tellular” Device

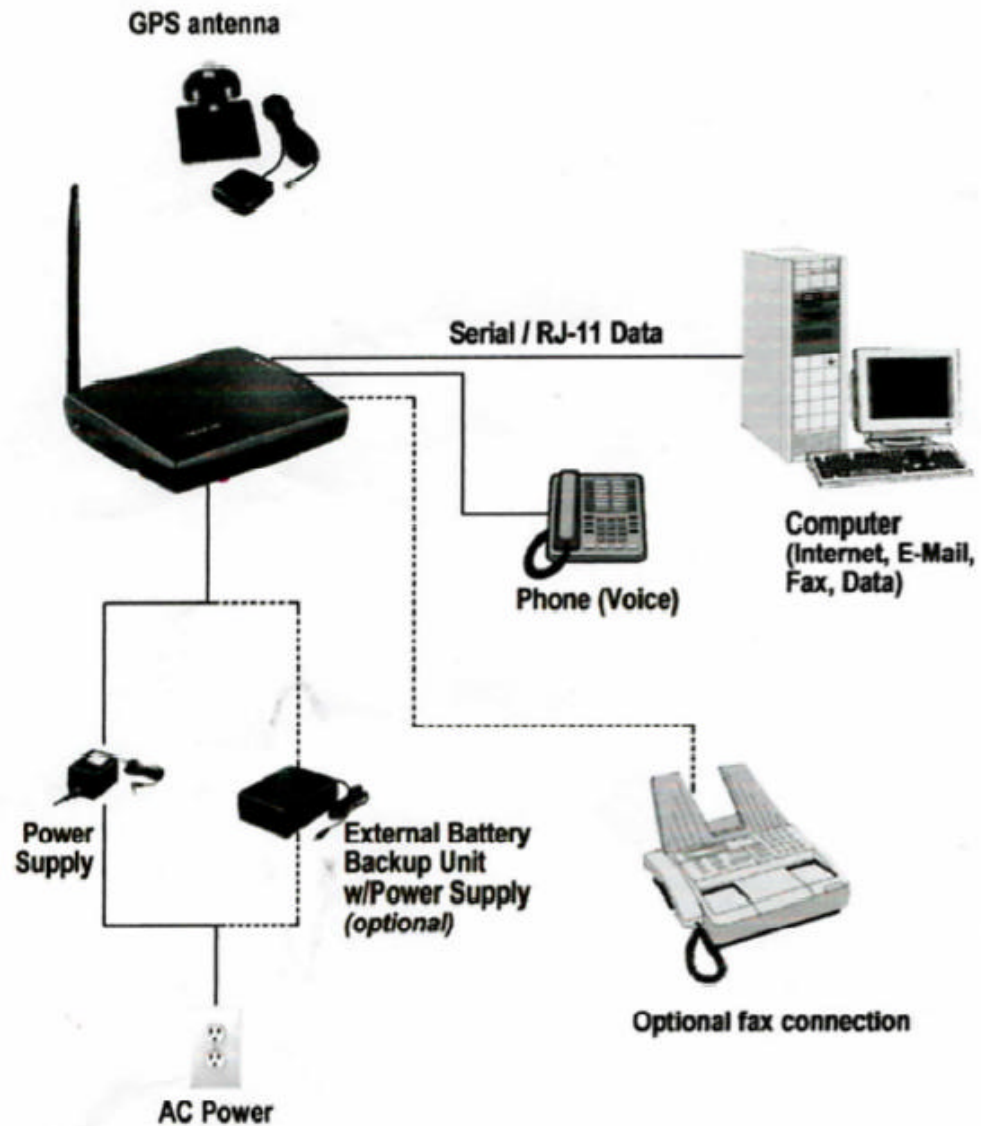


Intelligent RJ-11 Interface Environment

- Operating temperature range: -10°C to $+50^{\circ}\text{C}$
- Storage temperature range: -40°C to $+60^{\circ}\text{C}$
- Humidity: 5% to 95% (non-condensing)



Connectivity Options



Phonocell® SX5T-535C

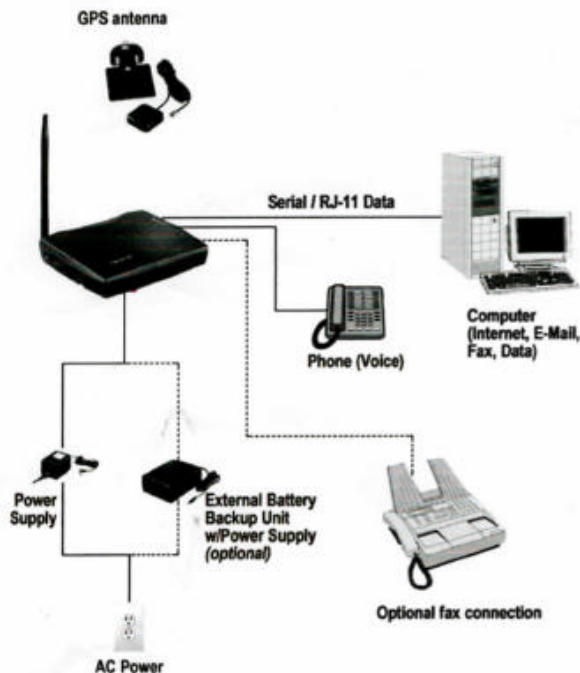
Fixed Cellular Terminal



Features

- 1X RTT packet data* (requires Telular custom serial data cable)
- Circuit switched digital computer fax and data via RJ-11 phone cable (V.8, V.22, V.22bis, V.32, V.32 TCM, V.32bis TCM)*
- Group 3 analog fax (V.17, V.21, V.27ter, V.29)*
- Compatible with popular supplementary services including caller ID, call waiting, 3-way calling, and call forwarding *
- Automatic end-of-dialing (no SEND key)
- Supports up to five phones (5 REN)
- Easy set-up using DTMF telephone or PC
- Simple desktop or wall-mount installation
- 8k EVRC and 13k QCELP vocoder support
- Hotline

Connectivity Options



Specifications

Air Interface Standard

- TIA/EIA/IS-2000A

Transmit Power

- 200 mW (23dBm)

Frequency Ranges

	Transmit	Receive
• CDMA 800	824-849 MHz	869-894 MHz
• PCS (CDMA) 1900	1850-1910 MHz	1930-1990 MHz

Dimensions and Weight

- Metric (cm) 18.2 W x 5.1 H x 21.1 L
- U.S. (inches) 7.1 W x 2.0 H x 8.3 L
- 0.57 kg. (1.3 lb.)

Environment

- Operating temperature range: -10°C to + 50°C
- Storage temperature range: -40°C to + 60°C
- Humidity: 5% to 95% (non-condensing)

Intelligent RJ-11 Interface

- Ringer equivalence number (REN) 5.0
- Dynamic echo cancellation
- PSTN Emulation

LED Indicators

- Power/Battery status
- Signal status
- Message status
- ON/OFF hook status

Connectors

- Two RJ-11 interface jacks for telephone, Group 3 analog fax, or analog data
- Data port for 1X RTT packet data or circuit-switched digital PC fax/data (optional serial data cable required)
- TNC antenna connector (50 ohms)
- SMA connector for GPS antenna
- DC power input jack

Antenna

- 2 dBi dipole antenna included
- Optional higher gain antennas

AC-to-DC Switching Power Supply (Included)

- Voltage: 110 - 230 VAC
- Frequency: 50/60 Hz

Emergency Battery Backup (Optional)

- 4 AA batteries provide up to 1 hour talk time and up to 3.5 hours of standby (Batteries Not Included)

External Battery Backup (Optional)

- Provides up to 3.5 hours talk time and up to 15 hours standby time

Approvals

- FCC ID: MTFCDMAFWT2004
- Verizon Wireless approved

Reasons why the ED can't receive the 12 lead ECG

- 1. ED Fax machine not turned on*
- 2. ED Fax machine not set to receive*
- 3. ED fax machine out of paper*
- 4. ED fax machine dedicated line disconnected*

*Thanks to
Terry Valenzuela, MD
Medical Director
Tucson Fire Department
January 25, 2007*

Other monitors have the ability to connect “digitally” and then send the 12 lead to a FAX machine

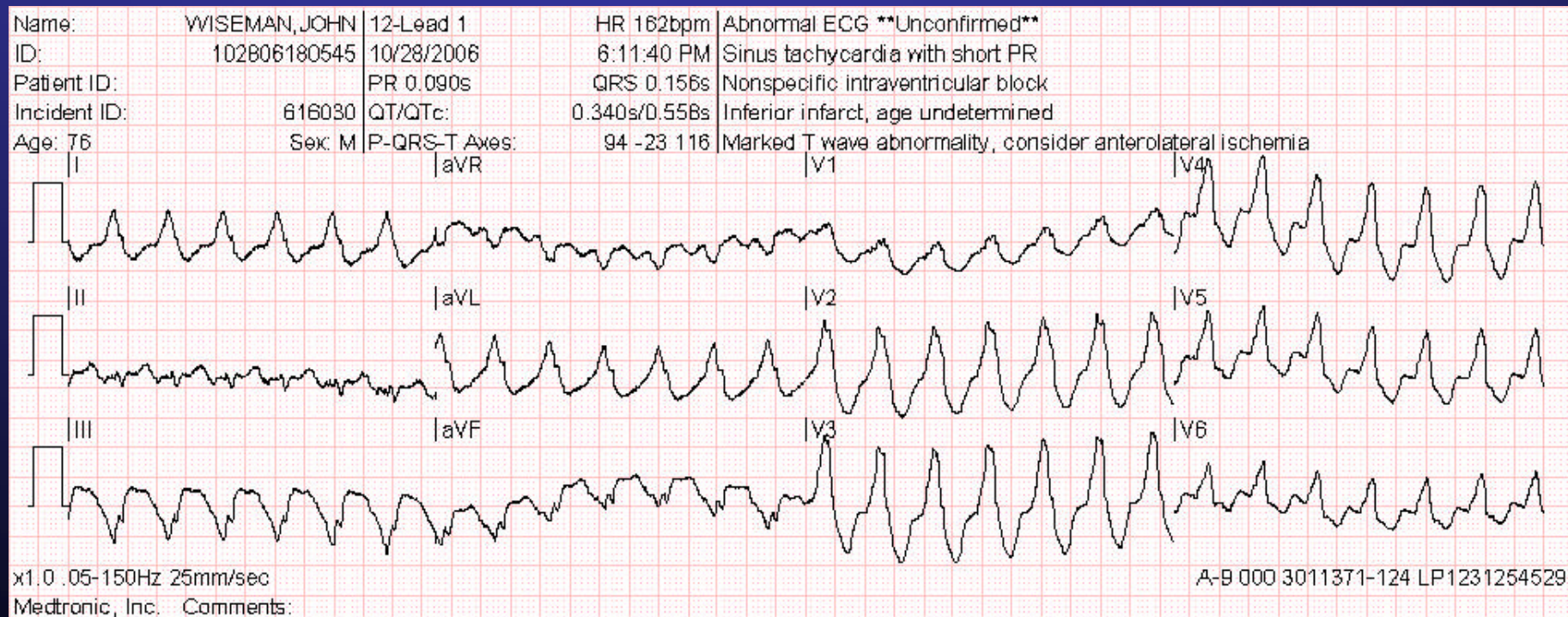


Advanced versions of the “FAX” Concept: The Digital “Receiving Station”

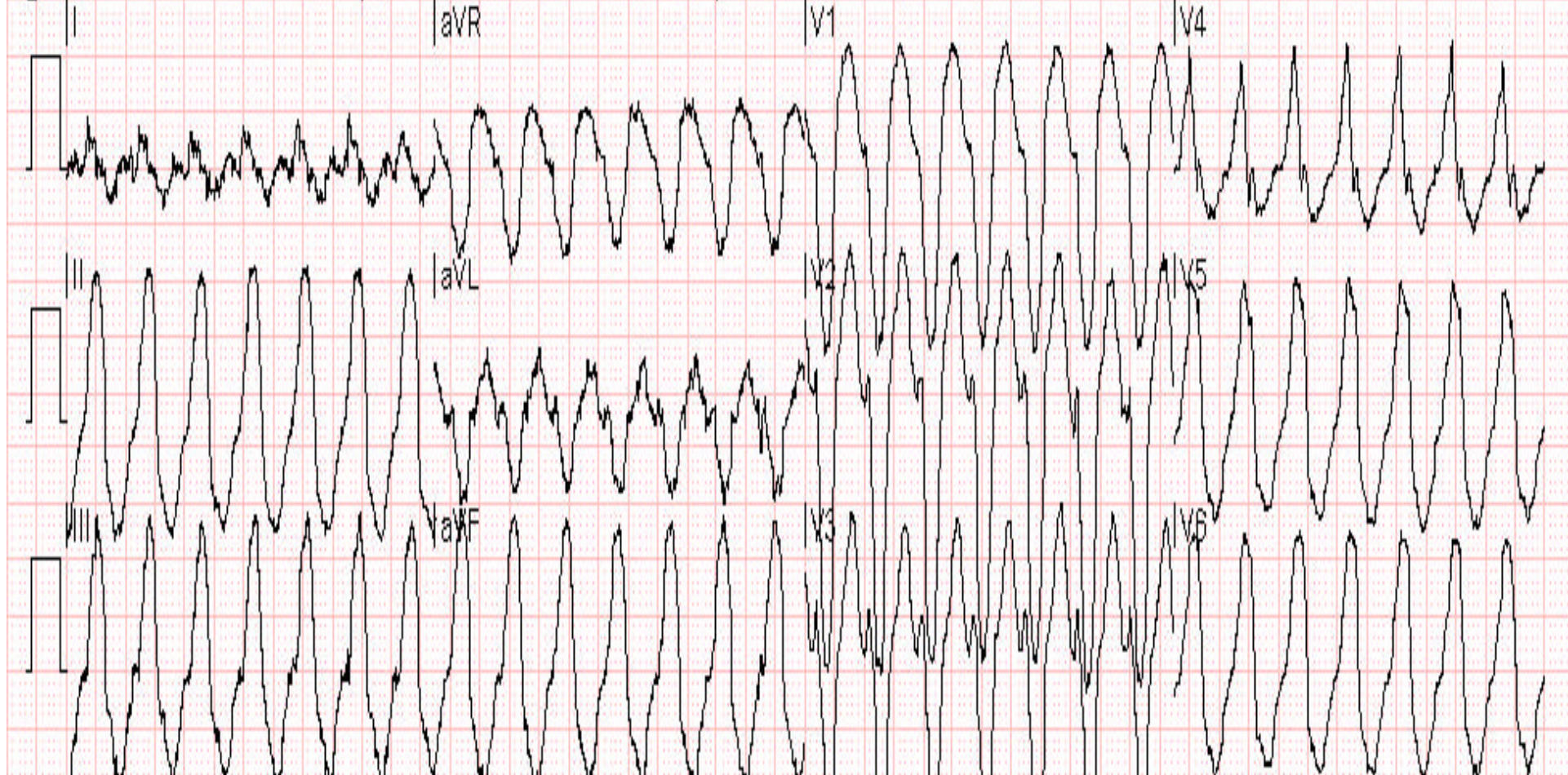
LIFENET® RS 3.0
Receiving Station



The quality of the images sent can be outstanding...



Name:	[REDACTED]	12-Lead 1	HR 169bpm	Abnormal ECG **Unconfirmed**
ID:	101406124512	10/14/2006	12:48:15 PM	wide QRS tachycardia
Patient ID:		PR 0.000s	QRS 0.188s	Left bundle branch block
Incident ID:	615292	QT/QTc:	0.350s/0.586s	
Age: 65	Sex: F	P-QRS-T Axes:	00 118	



x1.0 .05-150Hz 25mm/sec

Medtronic, Inc. Comments:

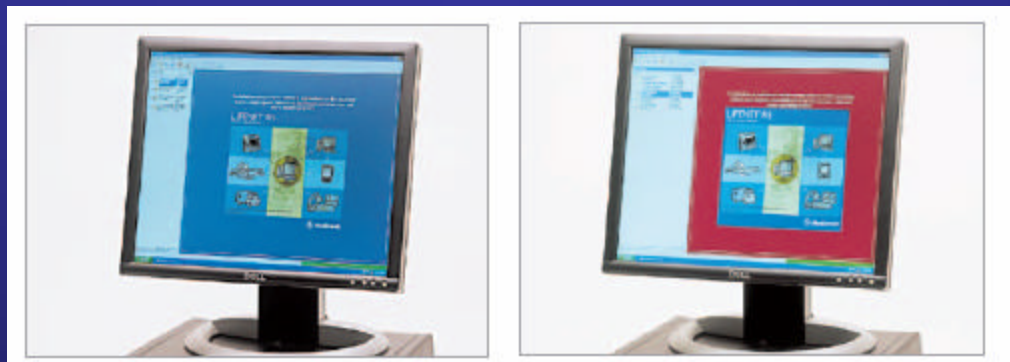
A-9 000 3011371-124 LP1231254529

REPORTING FEATURES:

- 12-lead ECG Report—receive patient data directly in the Emergency Department from a LIFEPAK 12 defibrillator/monitor in the field via landline, cellular or satellite phone.



- Trend Summary Report—includes patient information, vital sign values and trending graph.
- Vital Signs Summary Report – includes patient information, event and vital sign logs.
- Snapshot Report – includes patient information and 8 seconds of waveform data captured at the time of transmission.



Ischemia Management over Internet Protocol:

*The future is
(just about) now!*

PHILIPS



Power to see the big picture



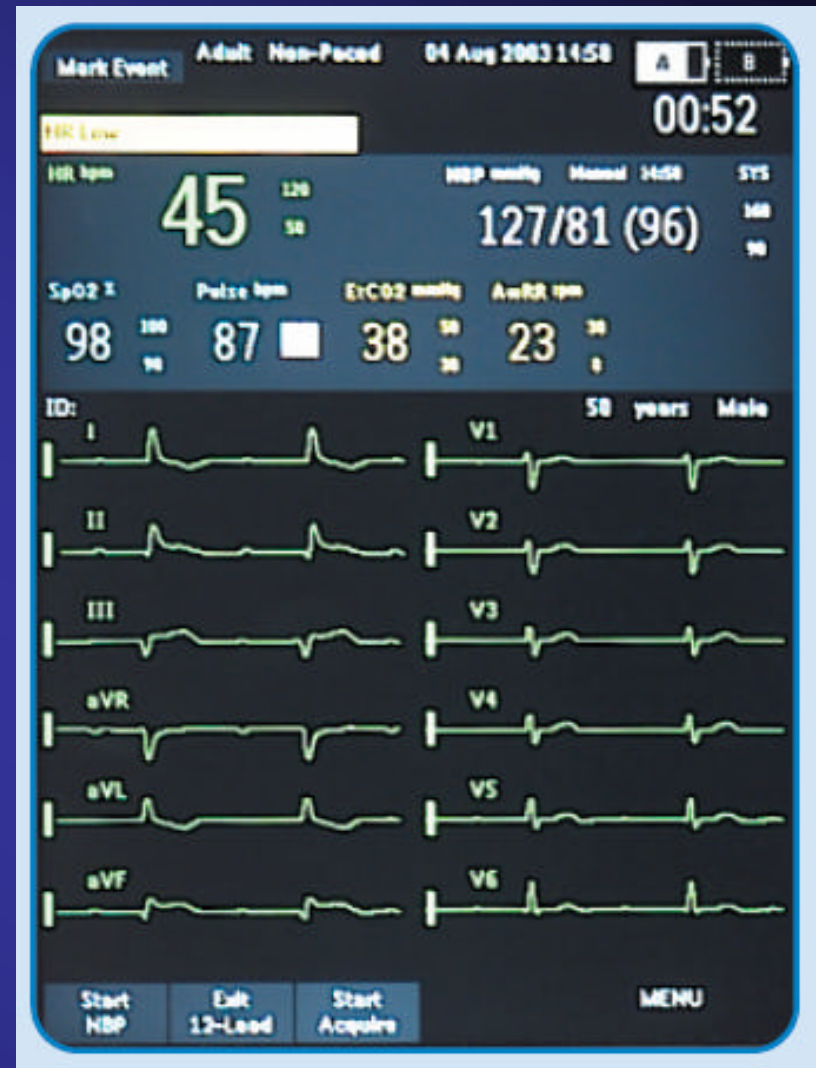
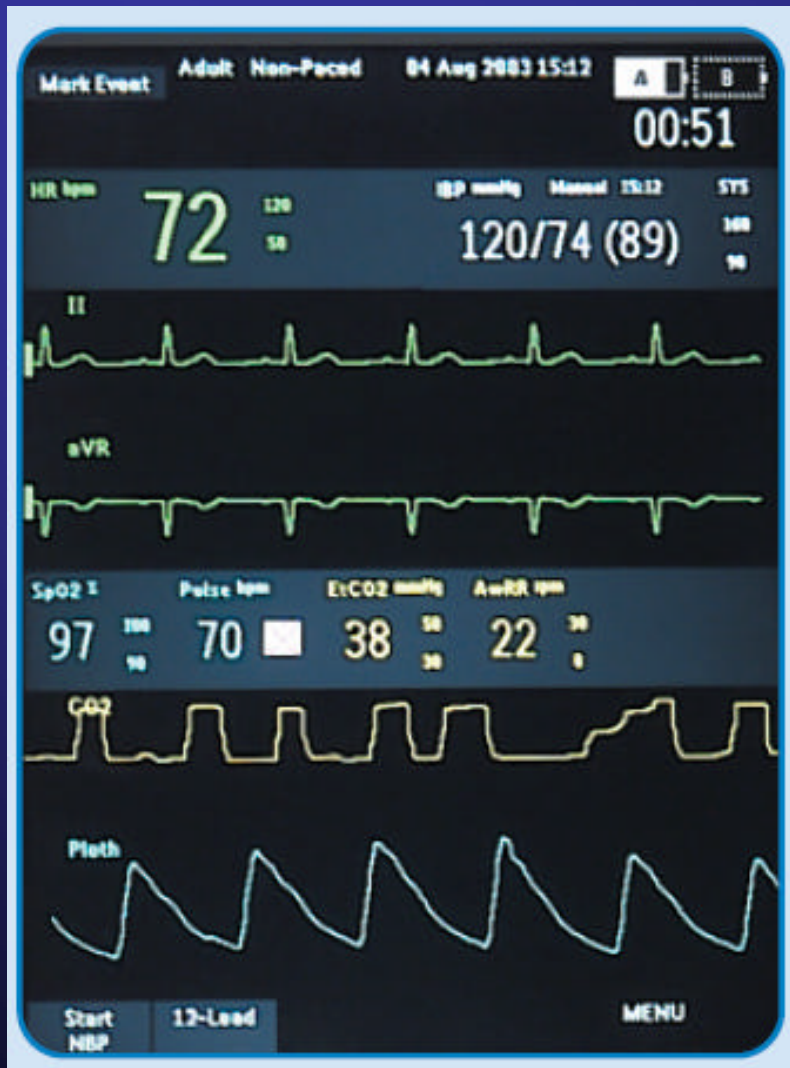


Measures
12.4 x 7.7 x 11.7 inches



Features

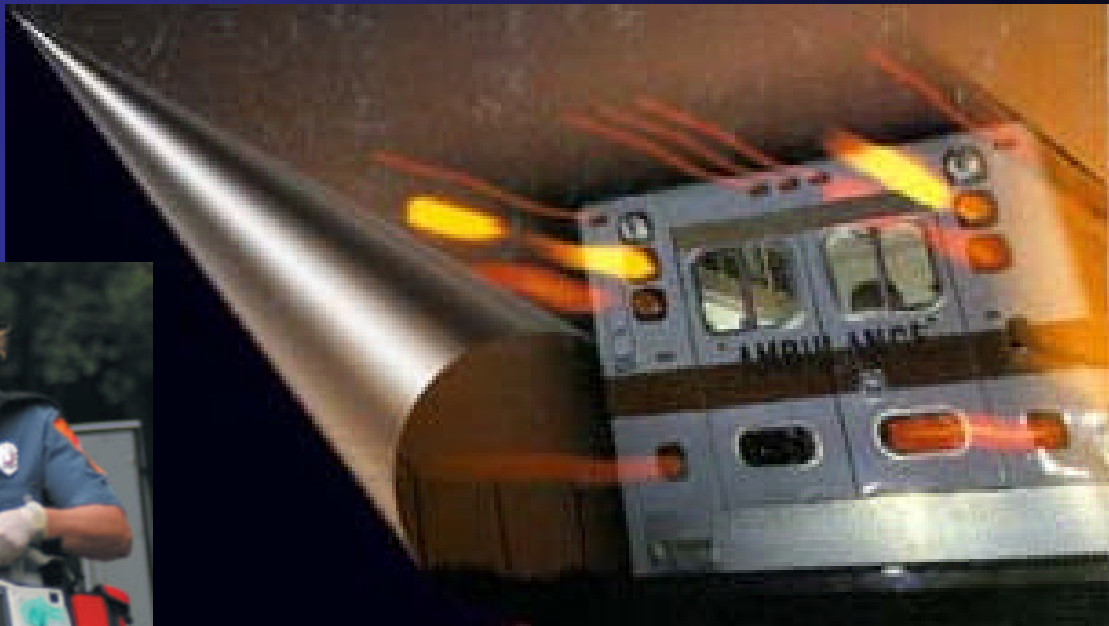
- Adjustable ECG size and autogain
- 8.4 inch (diag.), 4-wave color display, largest in its class
- 12-lead data transmission
- Data collection and event summary
- Strip chart printer
- Automated self-tests
- Operational checks
- Individual, adjustable volume of QRS beeper, voice prompts, and alerts
- Lithium ion battery (2 bays) with capacity gauge
- "Ready-for-Use" indicator
- Configuration mode
- Diagnostic mode
- Carrying Case
- Bed rail hook
- AC and DC power modules, optional
- Ambulance mounting bracket, optional





I2-Lead ECG

Input	I2-Lead cable: leads I, II, III, aVR, aVL, aVF, V1/C1-V6/C6
Display View	All I2-lead ECG waves display simultaneously
Strip Record	All I2-leads print on the strip chart printer in 3x4 format
Transmission	CompactFlash data card; cellular dial-up Internet connection



PHILIPS

Philips HeartStart 12-Lead Transfer Station Product Information



MRx ALS Monitor



Cell Phone



Wireless Tower



Internet Service
Provider

Point-of-care data transmission application

Philips HeartStart 12-Lead Transfer Station



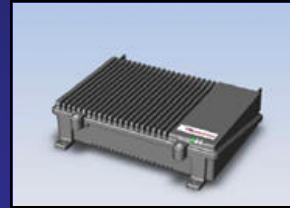
[HeartStart 12-Lead Transfer Station Data Sheet](#)

**For more
information....**

[Click Here](#)

HeartStart 12-Lead Transfer Station software, installed on an Internet-connected server, allows you to forward a 12-lead ECG report taken in the field from your HeartStart MRx monitor/defibrillator to the receiving hospital. This gives the Emergency Department and/or Catheterization Lab a head start in preparing for patient care while the patient is still en route, which is beneficial for many reasons:

- An emergency physician can give more informed treatment advice to the paramedic in the field
- The patient can be routed to the most appropriate hospital
- Precious hospital treatment minutes are saved, reducing myocardium damage
- Diagnosis and treatment may be better because it will be based on a true presenting rhythm before it has been temporarily improved by paramedic-administered drugs

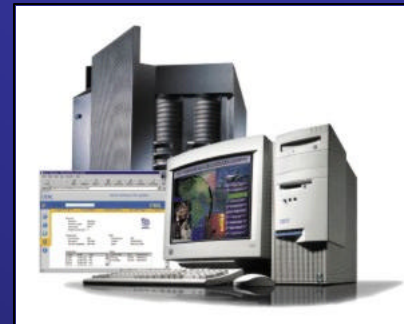


INTERNET

FAX to ER

*Email to ER
and PDA*

*Send to
Digital Receiving
Station*



**Physio is STILL planning
to release their upgraded
STEMI gateway
“soon” ...**

12-Lead Data Transmission

**Transmission capability
is OPTIONAL!!!**

capability is optional.

Source: Duke University Medical Center *More on:* Today's Healthcare, Heart Disease, Diseases and Conditions, Stroke Prevention, Medical Imaging, Vioxx
Date: March 21, 2006

ECG Transmission From Ambulance Cuts Time To Direct Clot Removal

Science Daily — When emergency medical technicians (EMTs) wirelessly transmit electrocardiograms (ECG) directly to a cardiologist's hand-held device, heart attack patients can potentially receive direct clot removal in half the usual time, according to cardiologists at Duke University Medical Center and NorthEast Medical Center, Concord, N.C.

Cutting this "door-to-reperfusion" time is critical, the cardiologists said, because the sooner a patient suffering from a heart attack receives an artery-opening procedure, the more likely heart muscle can be saved, and that the patient will potentially derive a survival benefit.

While the American College of Cardiology (ACC) and the American Heart Association recommend that patients have their arteries opened directly within 90 minutes of arriving at the hospital -- the NorthEast Medical Center team was able to cut that time to 50 minutes. The national average "door-to-reperfusion" is about 100 minutes, the researchers said.

The results of the pilot project were presented March 13, 2006, by Duke Clinical Research Institute cardiology fellow George Adams, M.D., during the 55th annual scientific sessions of the ACC in Atlanta. His study is one of five finalists for an ACC Young Investigator Award.

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Heart Disease

Signs, symptoms for men & woman. Learn more at www.Prevention.com

Improve HDL up to 50%

Raise HDL Cholesterol Guaranteed The Doctor-Recommended HDL Product
www.arizonapharmaceuticals.com

Heart Stent Lawsuits

Drug coated stents linked to blood clots & heart attacks.
www.youhavealawyer.com/stents

Herpes Transmission

How Genital Herpes is Spread & How to Lower Your Risk of Passing it on
www.manageherpes.com

Prevent Strokes

Flush out excess Fibrin, lowers the frictional resistance to blood flow
www.instituteforvibrantliving.com



*Direct to
PDA
can be
available*



And yet ANOTHER way to get connected:



onBoard™ Mobile Gateway 1000 Technical Specifications

Compatibility

- Operates with WiFi certified client devices (Intel Centrino Certified)
- Supports all client operating systems

WAN Wireless Networking

- Plug-in compatibility with current wireless WAN standards including GPRS, EDGE, UMTS, 1X RTT, EV-DO, UMTS TDD (IP Wireless), Flash-OFDM (Flarion)
- Future compatibility with new wireless WAN standards such as UMTS HSDPA, 802.16, EvDV, EVDO Rev A, 802.20
- Integration with other technologies through 802.11, Ethernet, USB
- PPP (RFC 2516)
- Mobile IP Support (Optional)

LAN Wireless Networking

- Ethernet
- IEEE 802.11b/g (AP and client)



Power Management System

- Auto Power-up
- Graceful Power-down

Dimensions

- Width: 10.79 in / 27.4cm
- Depth: 8.79 in / 22.3 cm
- Length: 2.37 in / 6.0 cm

Weight

- 6.5 lbs / 2.9 Kg

Platform

- Pentium
- 20G storage
- Linux
- OSGi
- GPS based reporting based on NMEA 0183 standard (Optional)

In Motion Technology, Inc.

Queen's Court
Suite 250
625 Agnes Street
New Westminster, BC
Canada V3M 5Y4
Telephone: (604) 523-2371
Fax: (604) 648-9629

*So, who is transmitting
12 leads, and
who isn't?*

“Yes” Responses to Poll of the Eagles Consortium, 01/24/07

Portland	Yes, with 65% success rate
Milwaukee	Yes, with 65% success rate
Dallas	Yes, but problems with different agencies
Raleigh	Yes, but Nextel problems
Seattle	Yes when possible
Tucson	Yes for 19 years
Nashville	Yes
Houston	Yes
Atlanta	Yes
Columbus	Yes

“No but working on it” Responses to Poll of the Eagles Consortium, 01/24/07

Philadelphia	Not yet, working on it, about to roll out 12 leads
Fort Worth	Not yet, working on it
San Diego	Not yet, working on it
Cleveland	Not yet, working on it
El Paso	Not yet, working on it
New Orleans	Not yet, working on it
Austin	Not yet, working on it
Richmond	Not yet, working on it
New York	Not yet, working on it
L.A.	Not yet, thinking about it

“No” Responses to Poll of the Eagles Consortium, 01/24/07

Honolulu	No, medics well trained, plus short transport times
Miami	No, medics well trained, plus short transport times
Phoenix	No, medics well trained, plus short transport times
Indianapolis	No, medics well trained, plus short transport times
Chicago	No, medics well trained, plus short transport times
Boston	No, medics well trained, plus short transport times
San Francisco	No, and don't have 12 leads
Charlotte	No

Email Addresses of the “Yes” Responders from the Eagles Consortium

Ray Fowler, Dallas: snerd@earthlink.net

Terry Valenzuela, Tucson: terry@aemrc.arizona.edu

David Persse, Houston: david.persse@cityofhouston.net

Brent Myers, Raleigh: brent.myers@co.wake.nc.us

Eric Ossman, Atlanta: eossman@emory.edu

Ron Pirallo, Milwaukee: pirrallo@mcw.edu

Corey Slovis, Nashville: slovis.corey@vanderbilt.edu

Dave Keseg, Columbus: dkeseg@iwaynet.net

Jonathan Larsen, Seattle: jonathan.larsen@seattle.gov

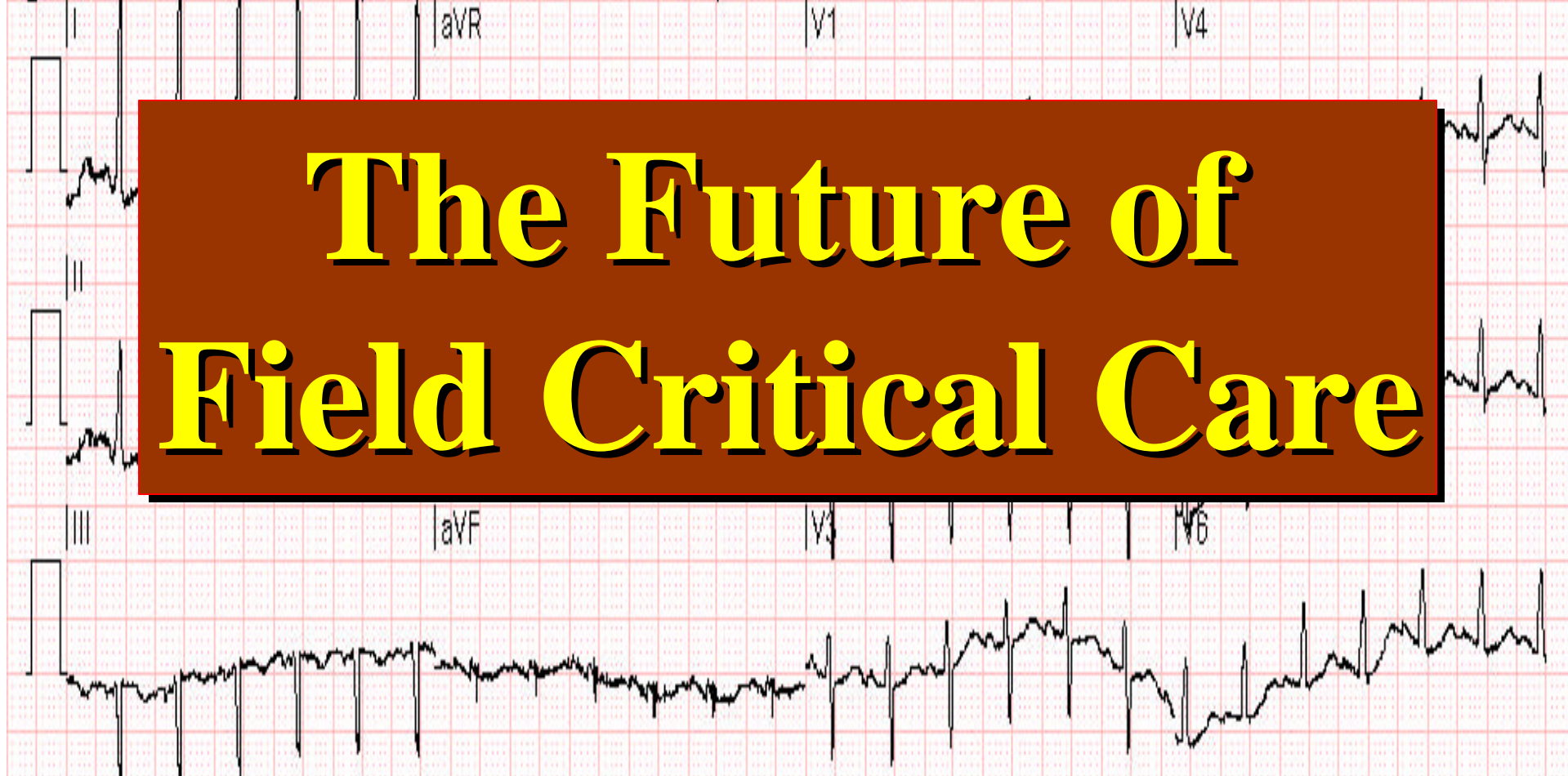
**Don't make the mistakes
that we've made...**



...make some of your own!!

Name:	HERNANDEZ	12-Lead 1	HR 149bpm	Abnormal ECG **Unconfirmed**
ID:	101506021250	10/15/2006	2:21:32 AM	Sinus tachycardia
Patient ID:		PR 0.116s	QRS 0.068s	Minimal voltage criteria for LVH, may be normal variant
Incident ID:	615322	QT/QTc:	0.264s/0.415s	Nonspecific ST and T wave abnormality
Age: 66	Sex: F	P-QRS-T Axes:	35 3 6	

The Future of Field Critical Care

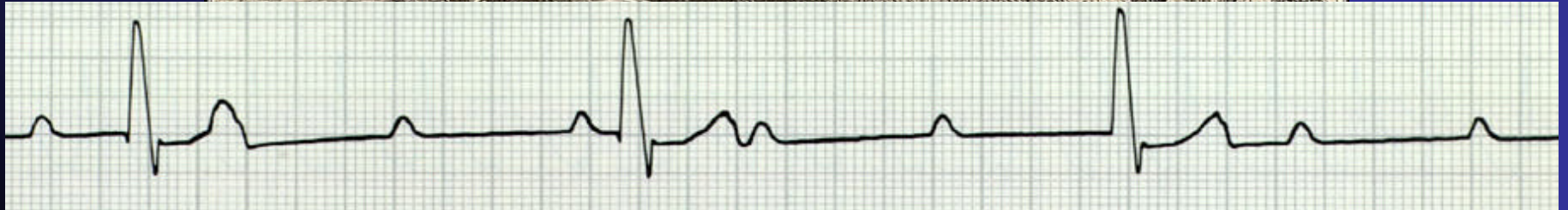
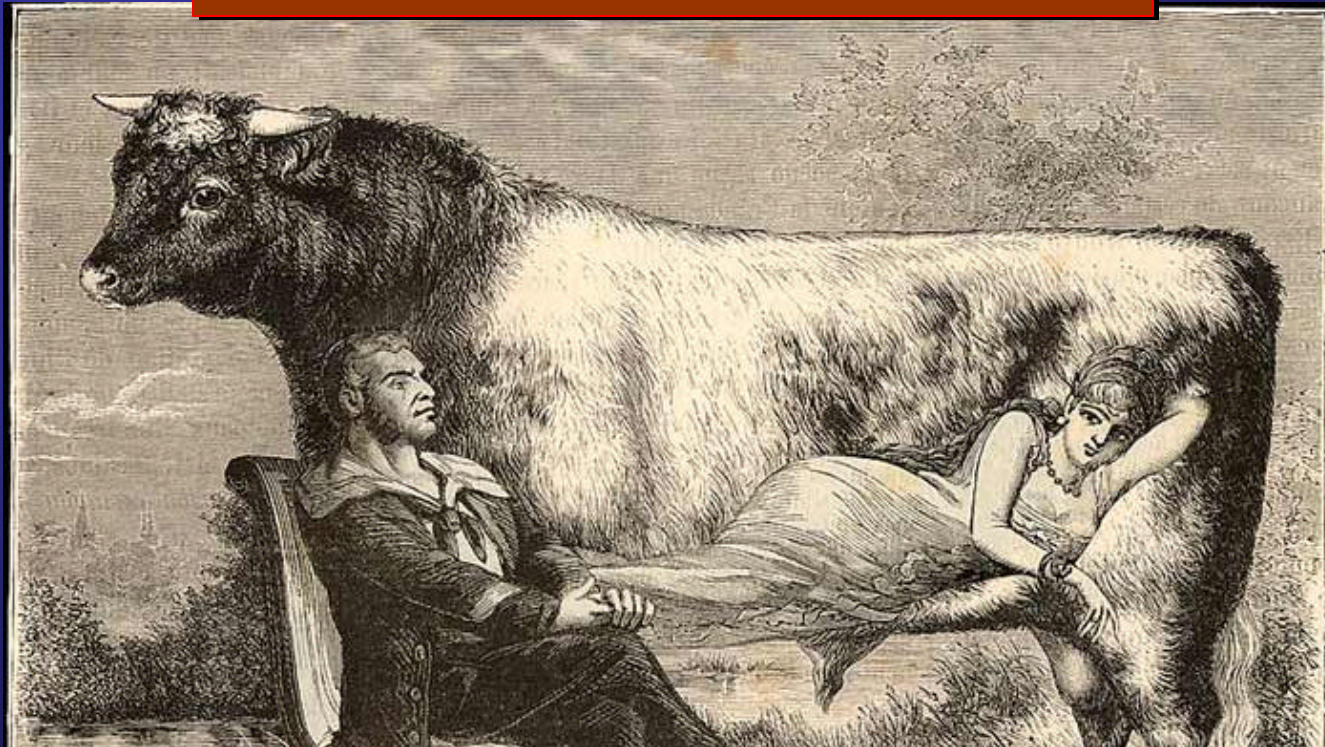


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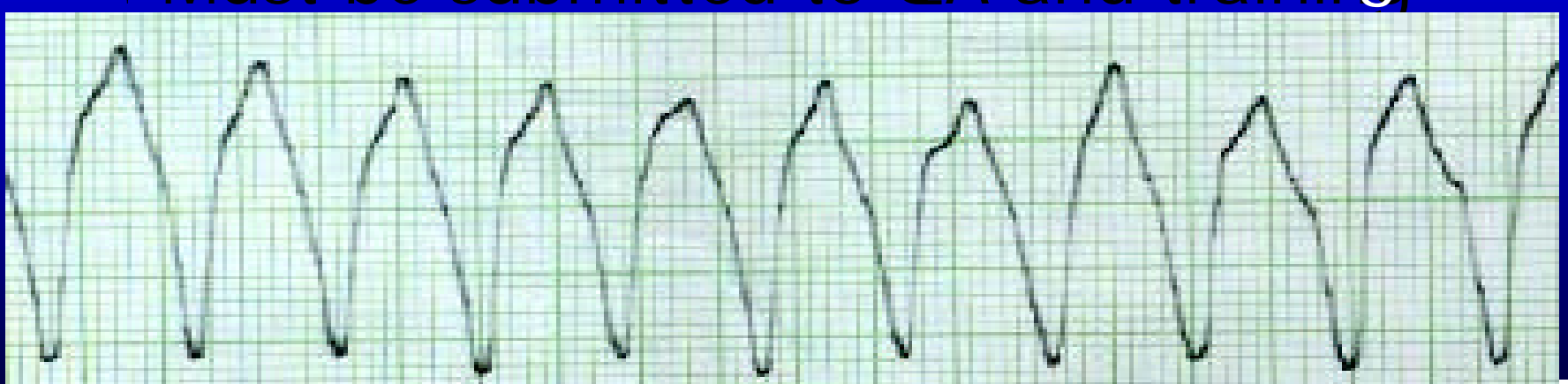
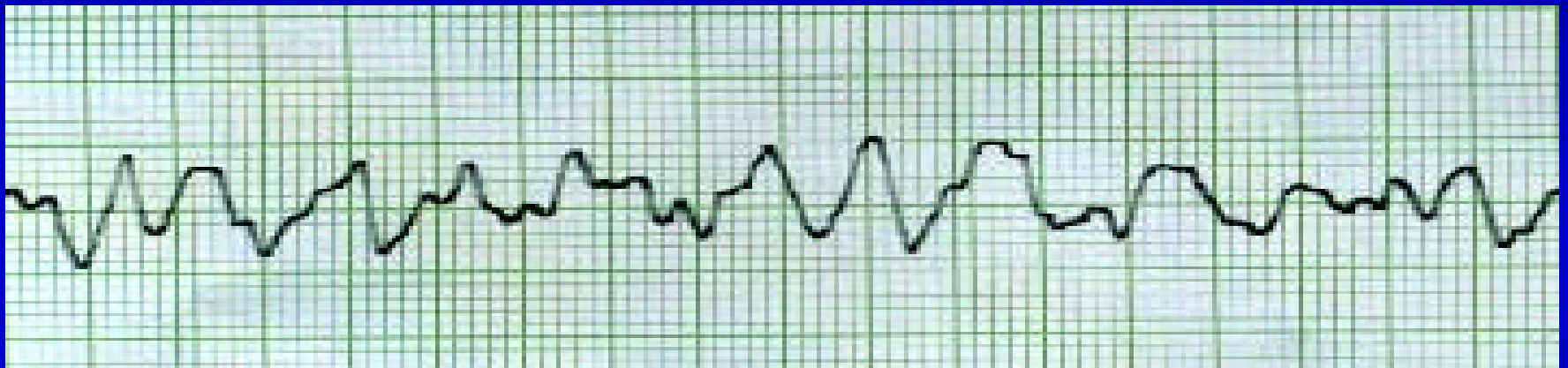
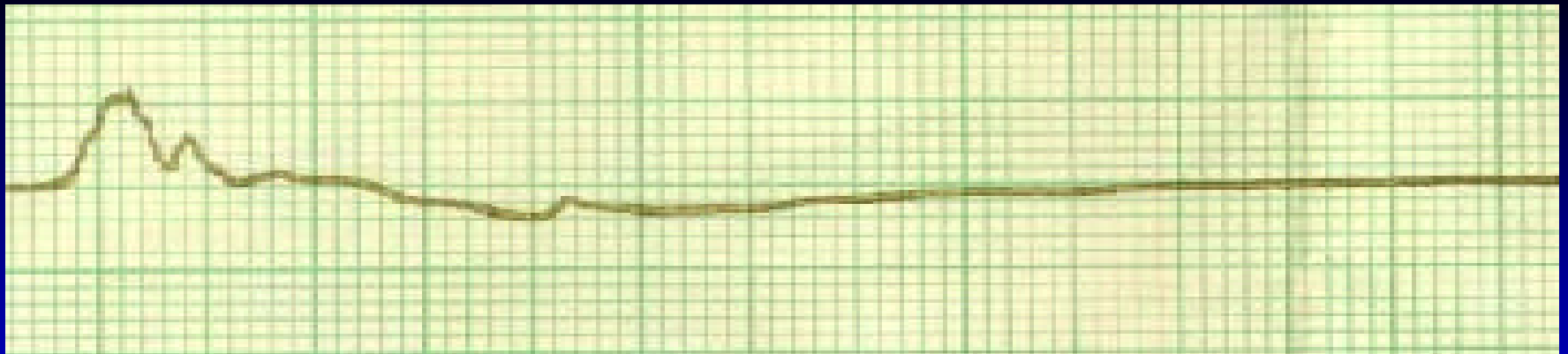
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Medtronic, Inc. Comments:

Some assorted ruminations...



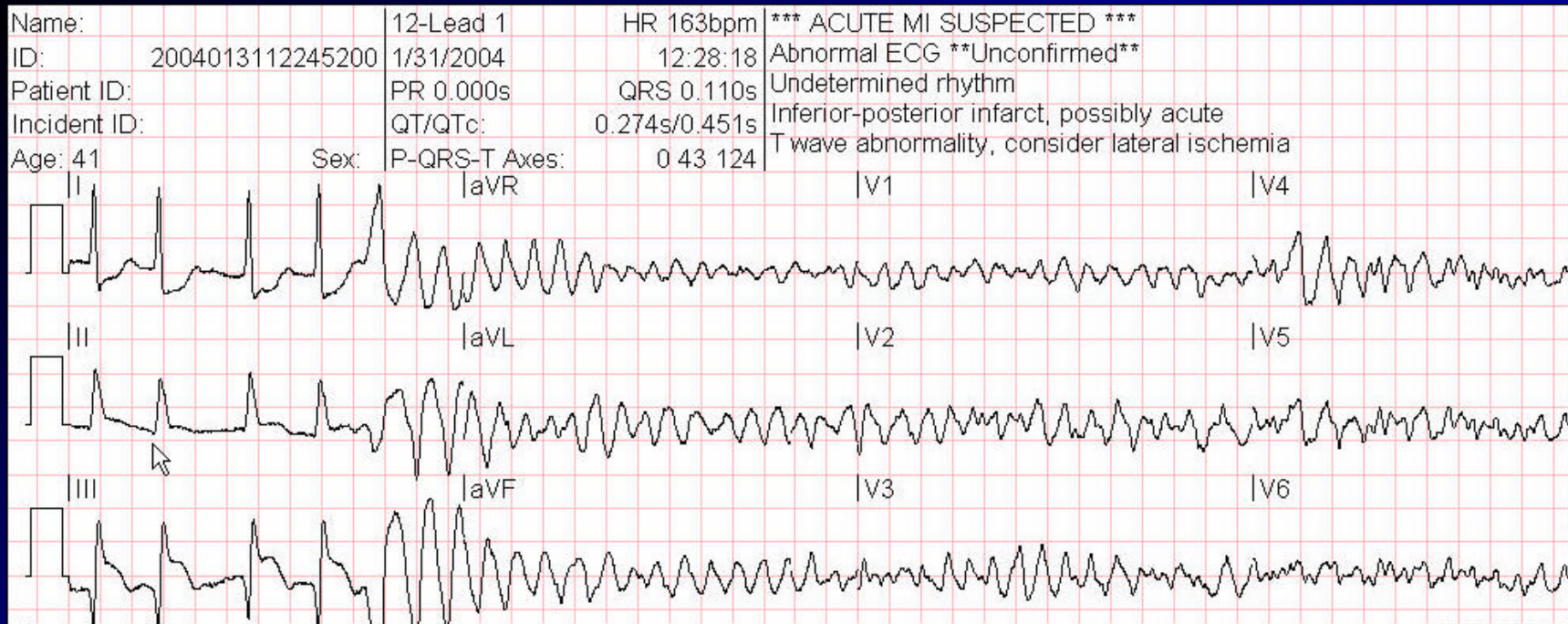
W. H. WOODS



Rhythms

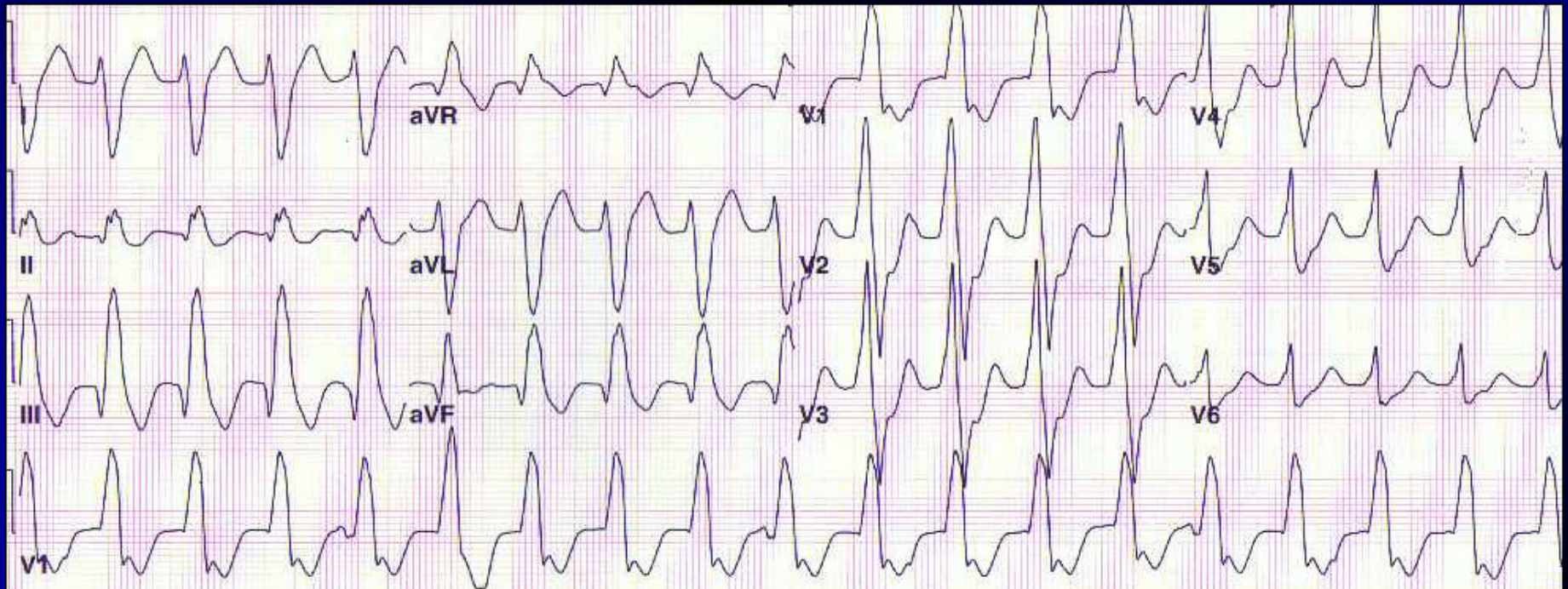
- ✦ We must develop a systematic approach for interpretation and management of more difficult rhythms





***The end users in the system
must always remember
that technical capability
NEVER replaces
good sense clinical care***

***ECG Transmission
is a piece of the puzzle
not the puzzle itself***

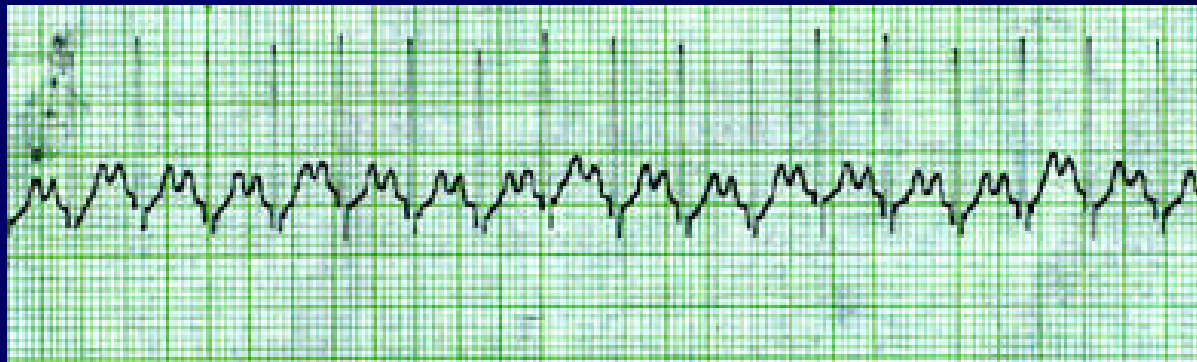


***Understanding
tachycardia,
for example***

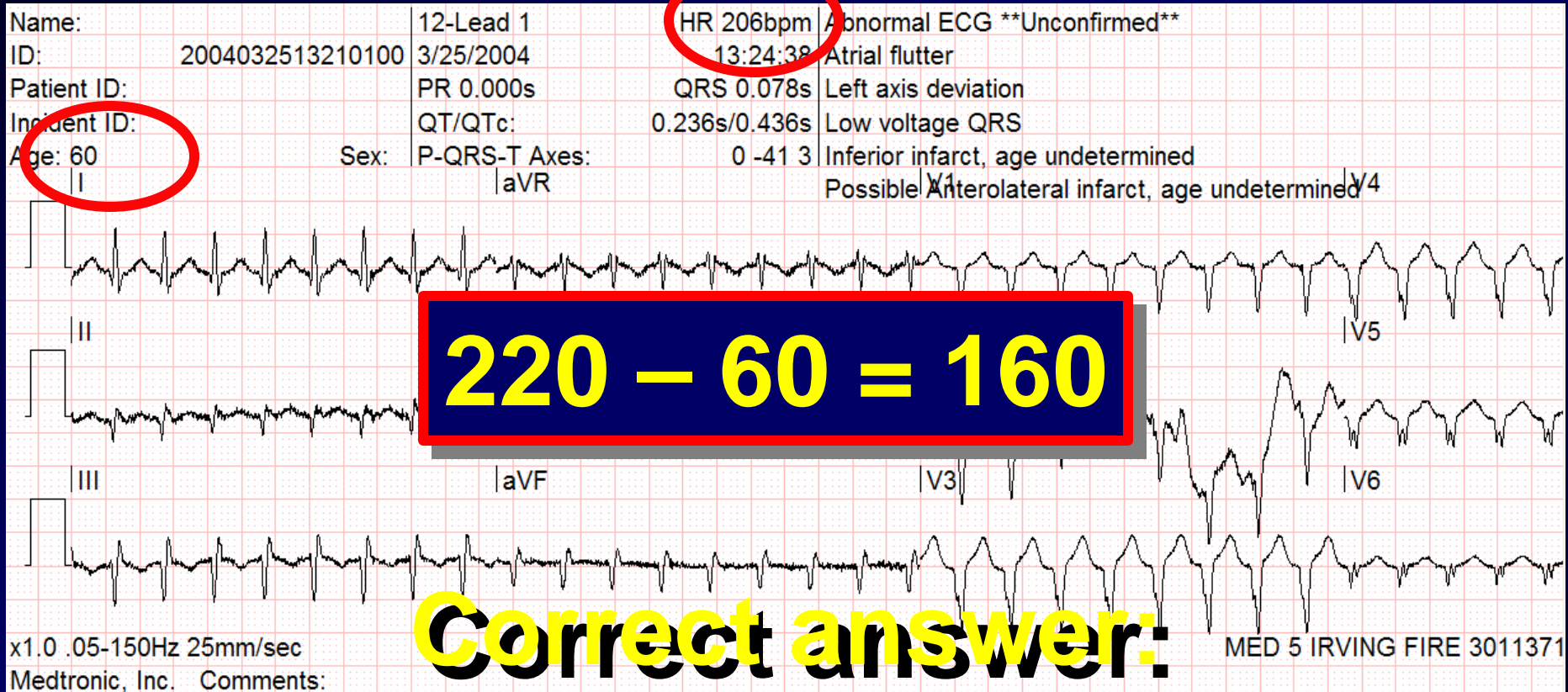
$$\text{Baby} = (220 - 0) = 220$$

$$\text{Snerd} = (220 - 53) = 167$$

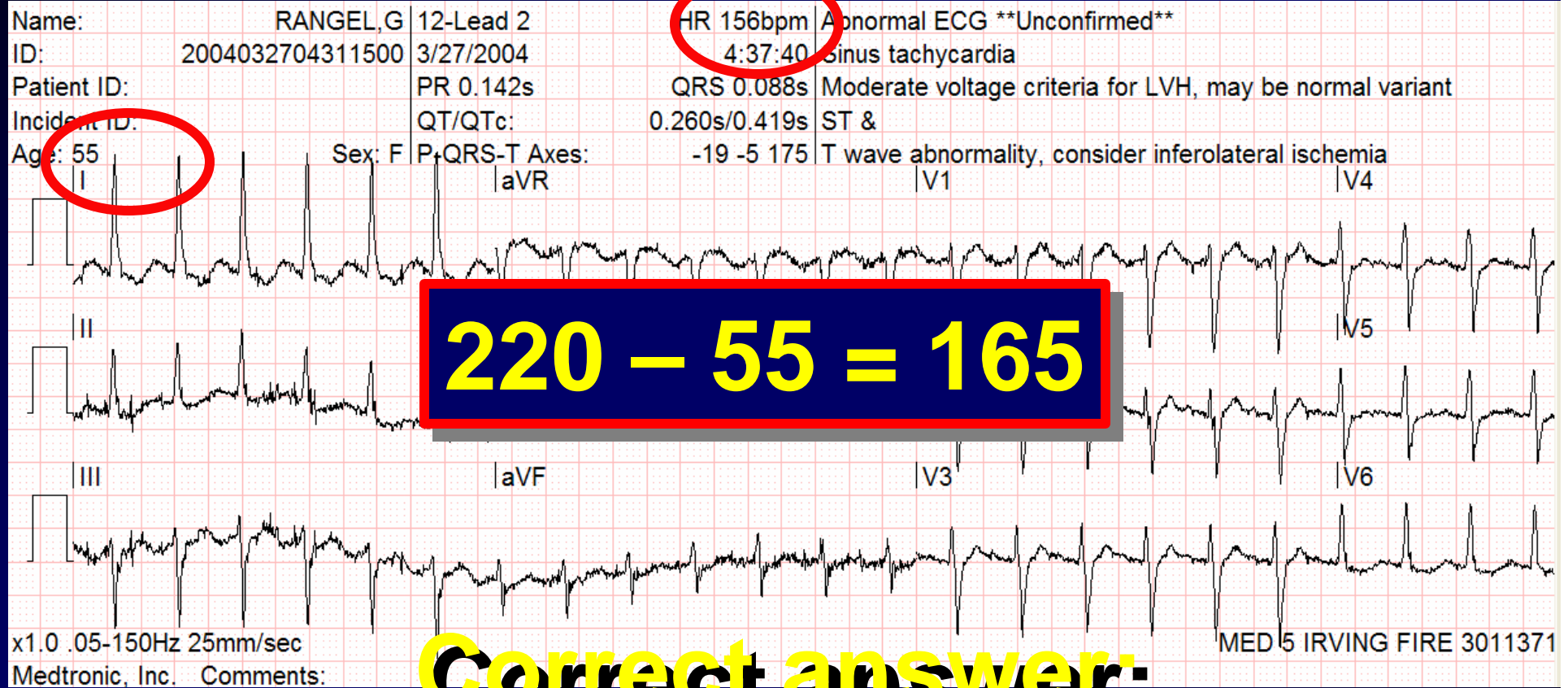
$$\text{Aunt Minnie} = (220 - 70) = 150$$



What is this rhythm?



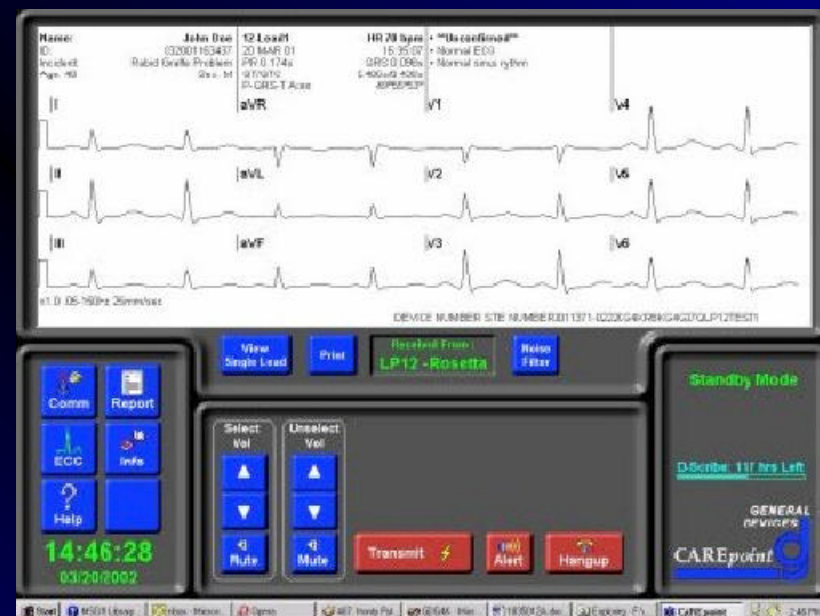
What is this rhythm?

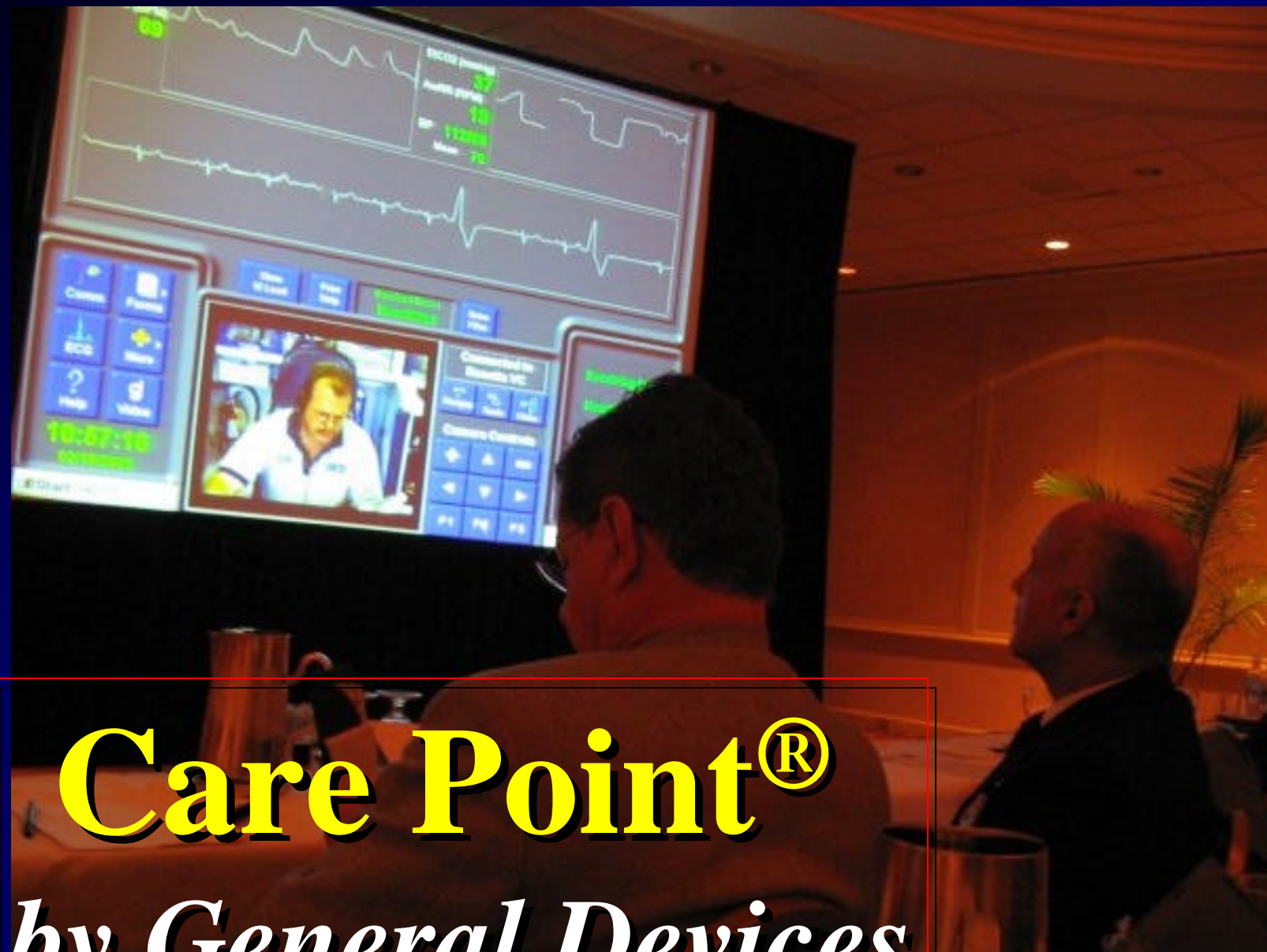


**...and what Medics
MUST know:**

**Remember that
patients having
near maximum
sinus tachycardia
at rest
are dying!**

REAL Time Data Transfer





Care Point[®]

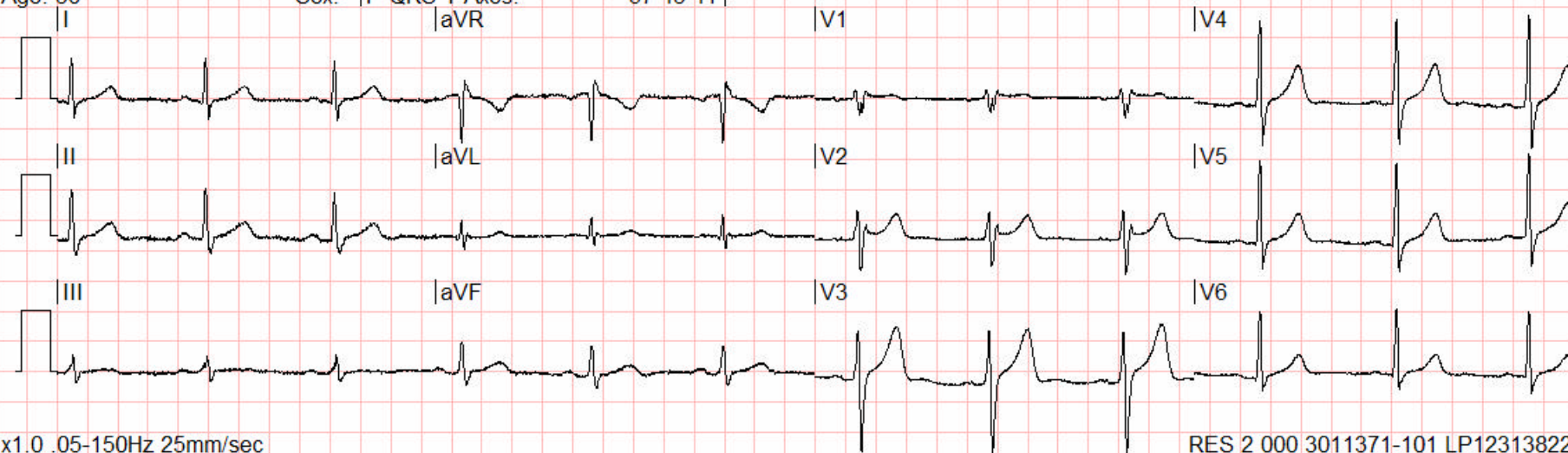
by General Devices

**Tucson should be
live with one of the
first implementations
in the near future
using a city-wide
router system**

Waveform View

File Edit View Help

Name: 12-Lead 1 HR 68bpm Normal ECG ****Unconfirmed****
 ID: 2006011309313500 1/13/2006 9:33:39 Normal sinus rhythm
 Patient ID: PR 0.160s QRS 0.098s
 Incident ID: QT/QTc: 0.380s/0.404s
 Age: 30 Sex: P-QRS-T Axes: 57 43 41



x1.0 .05-150Hz 25mm/sec

RES 2 000 3011371-101 LP1231382227

Medtronic Physio-Control Comments:

Device	Device ID	New	Report	T...	Time	Elapsed Time	Event Type	*	Note
LP12	RES 2		Continuous Com...	I...	09:31:38	00:00:00	Power On	🟢	
LP12	RES 2		12-Lead 1	I...	09:31:38	00:00:00	Start Trend Data	🟢	
LP12	RES 2		Generic	I...	09:31:41	00:00:03	Initial Rhythm	🟢	
LP12	RES 2		Adenosine	I...	09:33:39	00:02:00	12-Lead 1	🟢	
LP12	RES 2		ATROVENT	I...	09:34:16	00:02:37	NIBP	🟢	
LP12	RES 2		AMIODARONE	I...	09:35:41	00:04:03	Generic	🟢	
LP12	RES 2		Initial Rhythm	I...	09:35:51	00:04:12	Adenosine	🟢	
LP12	RES 2		Start Trend Data	I...	09:35:57	00:04:19	ATROVENT	🟢	
					09:36:03	00:04:24	AMIODARONE	🟢	
					09:36:37	00:04:59	Vital Signs	🟢	



66.34.180.153 - Remote Desktop

DALLAS_200... IMMEDIATE...

My Computer CODE-STAT Reviewer

My Network Places DALLAS_200...

Internet Explorer zip.07052006

d2d.web Windows Explorer

CMD RescueNet Code Review

d2d.web.rar Adobe Reader 7.0

Recycle Bin

Tomcat 5

Tomcat 5 Service

MySQL Administrator

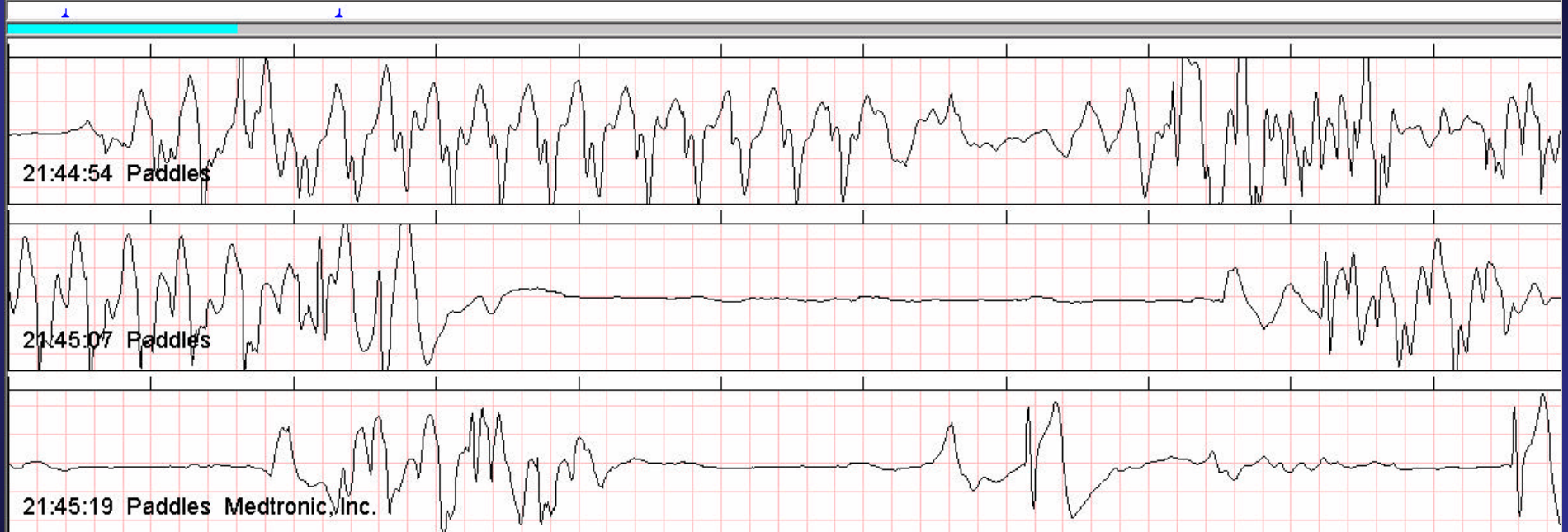
Start Services Select CMD CMD D:\INETPUB\UTSOUTHW...

LIFENET Case View - Waveform View

File Edit View Help

25.0 mm x1.0 3 0:03:45 0:29:50 2 0

Show CPR Events <c> <v> <Initial Rhythm> <BOE> <TOE> <ROSC> <End ROSC>



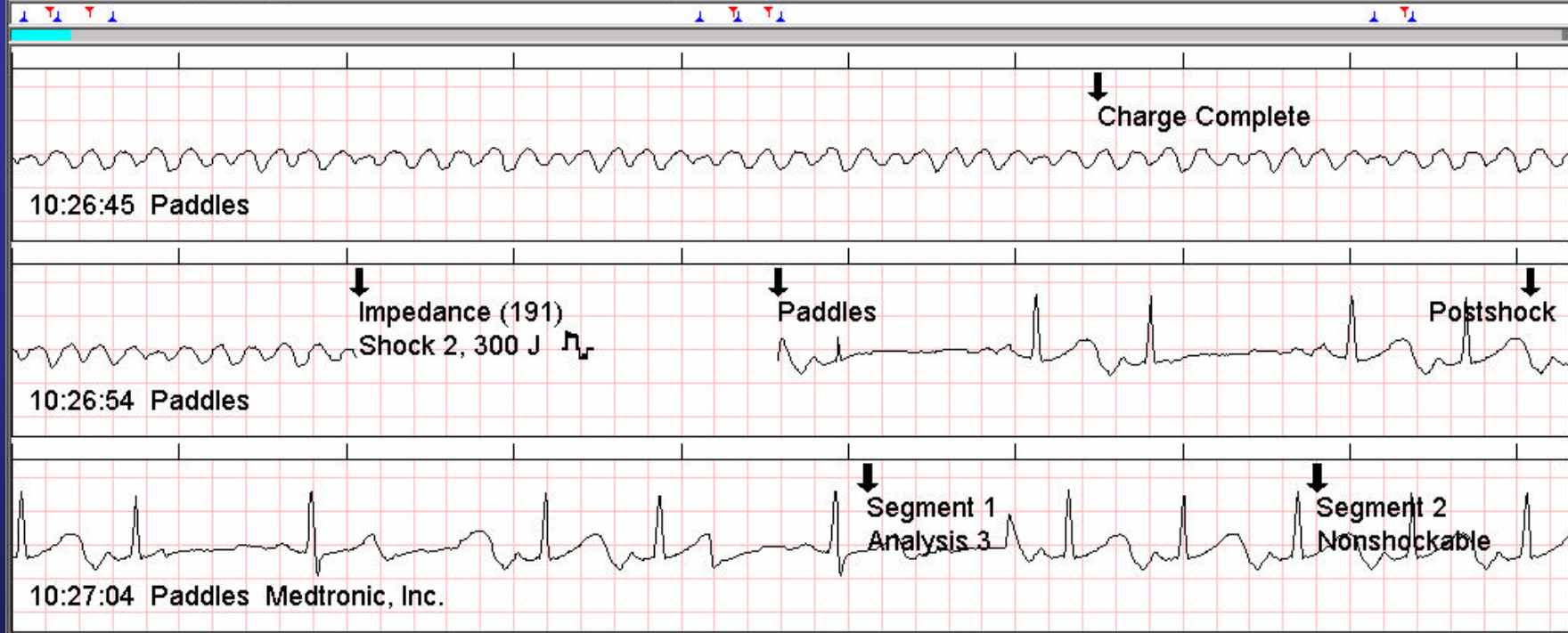
Device	Device ID	New	Report	*	Time Adjust...	Time	Elapsed Time	Event Type	*	Note	HR	SpO2*PR	EtCO2(mmHg)*RR	NIBP(mmHg)*PR	P1(mmHg)	P2(mmHg)
LP12	M131	⊕	Continuous Complete	⊗	00:00:19	21:41:09	00:00:00	Power On	♥							
LP12	M131	⊕	No Shock Advised		00:00:19	21:41:58	00:00:49	Advisory Mode	♥		--					
LP12	M131	⊕	No Shock Advised		00:00:19	21:42:03	00:00:54	Initial Rhythm	♥		--					
LP12	M131	⊕	Initial Rhythm		00:00:19	21:42:06	00:00:57	Analysis 1	♥		--					

LIFENET Case View - Waveform View

File Edit View Help

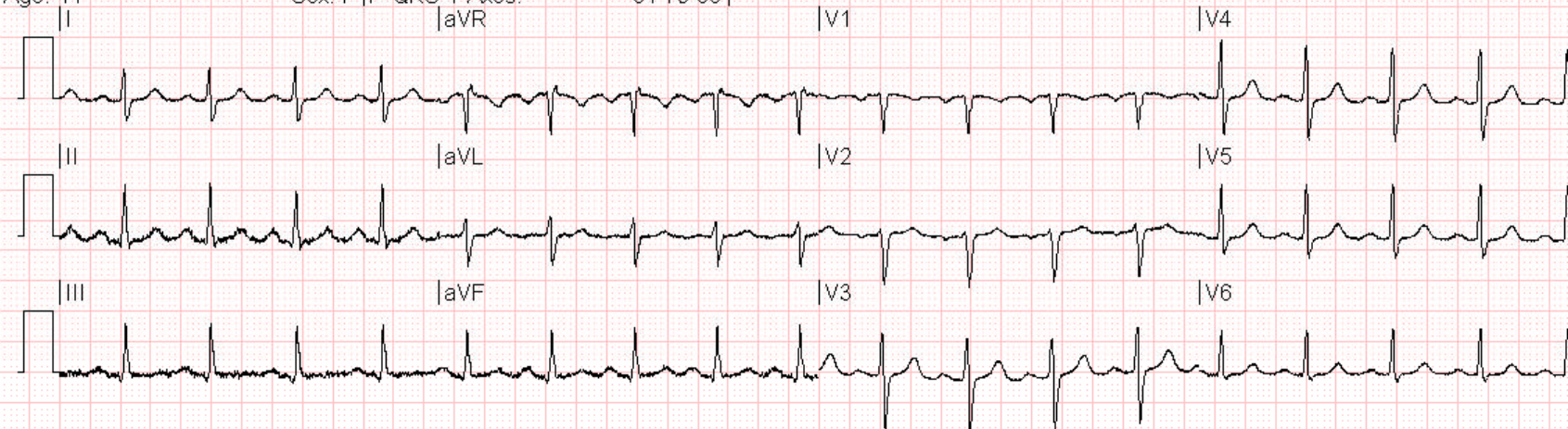
25.0 mm x1.0 3 0:00:32 0:14:22 8 5

Show CPR Events <C> <V> <Initial Rhythm> <BOE> <TOE> <ROSC> <End ROSC>



Device	Device ID	New	Report	*	Time Adju...	Time	Elapsed Time	Event Type	*	Note	HR	SpO2*PR	EtCO2(mmHg)*RR	NIBP(mmHg)*PR
LP12	B		Continuous Complete		00:00:03	10:20:00	-00:01:45	Time of Collapse						
LP12	B		Start Trend Data		00:00:03	10:21:45	00:00:00	Call Receipt						
LP12	B		Initial Rhythm		00:00:03	10:21:55	00:00:10	Dispatched - B...						
LP12	B		Shock Advised		00:00:03	10:25:30	00:03:45	Arrive Scene - ...						
LP12	B		Shock 1, 200 J		00:00:03	10:26:00	00:04:15	Arrive Patient - ...						
LP12	B		Shock Advised		00:00:03	10:26:13	00:04:28	Power On						
LP12	B		Shock 2, 300 J		00:00:03	10:26:13	00:04:28	Start Trend Data						
LP12	B		No Shock Advised		00:00:03	10:26:18	00:04:33	Advisory Mode						
LP12	B		Oxygen		00:00:03	10:26:20	00:04:35	Analysis 1						
LP12	B		12-Lead 1		00:00:03	10:26:20	00:04:35	Initial Rhythm						
LP12	B		Shock Advised		00:00:03	10:26:25	00:04:40	Shock Advised						

Name: 12-Lead 1 HR 107bpm Otherwise normal ECG **Unconfirmed**
 ID: 102406022623 10/24/2006 2:35:32 AM Sinus tachycardia
 Patient ID: PR 0.170s QRS 0.084s
 Incident ID: QT/QTc: 0.306s/0.408s
 Age: 41 Sex: F P-QRS-T Axes: 54 79 50



x1.0 .05-150Hz 25mm/sec

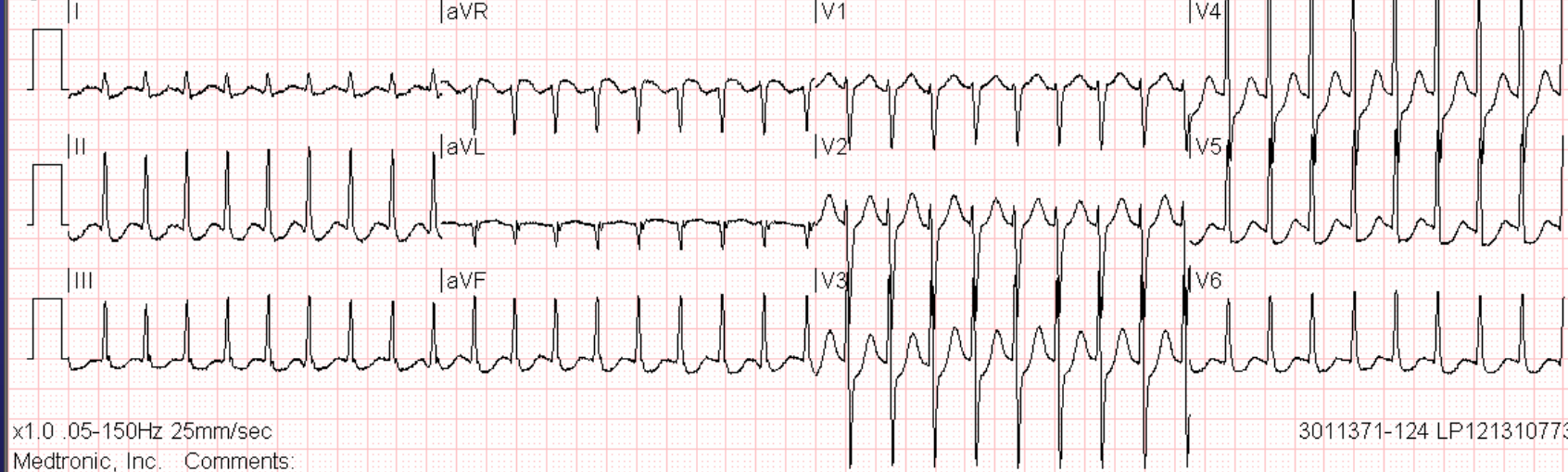
3011371-124 LP1213728286

Medtronic, Inc. Comments:

Device	Device ID	New	Report	*	Time Adjust...	Time	Elapsed Time	Event Type	*	Note	HR	SpO2*PR	EtCO2(mmHg)*RR	NIBP(mmHg)*PR	P1(mmHg)	P2(mmHg)
LP12	Unknown	⊗	Continuous Complete	✗	00:00:21	02:26:44	00:00:00	Power On	♥							
LP12	Unknown	⊗	Start Trend Data		00:00:21	02:26:44	00:00:00	Start Trend Data	♥							
LP12	Unknown	⊗	Initial Rhythm		00:00:21	02:31:05	00:04:21	Initial Rhythm	♥							
LP12	Unknown	⊗	Print 1		00:00:21	02:31:14	00:04:30	Print 1	♥		118					
LP12	Unknown	⊗	12-Lead 1		00:00:21	02:31:42	00:04:58	Vital Signs	♥		113					
LP12	Unknown	⊗	Print 2		00:00:21	02:34:53	00:08:09	NIBP	♥		111	100*108		154/97(112)*111		
						02:35:32	00:08:48	12-Lead 1	♥							
						02:36:42	00:09:58	Vital Signs	♥		111	100*110				
						02:37:58	00:11:14	NIBP	♥		112	98*105		--/--)*--		
						02:40:34	00:13:50	Print 2	♥		124	97*116				
						02:41:03	00:14:19	NIBP	♥		124	100*122		--/--)*--		
						02:41:42	00:14:58	Vital Signs	♥		126	100*126				
						02:41:42	00:14:58	NIBP	♥		126	100*126		--/--)*--		
						02:43:33	00:16:49	NIBP	♥		121	100*121		213/140(148)*...		
						02:46:22	00:19:38	NIBP	♥		124	100*124		--/--)*--		
						02:46:42	00:19:58	Vital Signs	♥		122	100*123				
						02:51:42	00:24:58	Vital Signs	♥		--	--*--				
						02:53:12	00:26:28	Power Off	♥							

File Edit View Help

Name:	12-Lead 2	HR 215bpm	Abnormal ECG **Unconfirmed**
ID:	101706211852	10/17/2006	9:59:57 PM
Patient ID:	PR 0.000s	QRS 0.070s	Marked ST abnormality, possible inferior subendocardial injury
Incident ID:	QT/QTc:	0.210s/0.397s	Marked ST abnormality, possible anterior subendocardial injury
Age: 57	Sex: F	P-QRS-T Axes:	0 80 -75



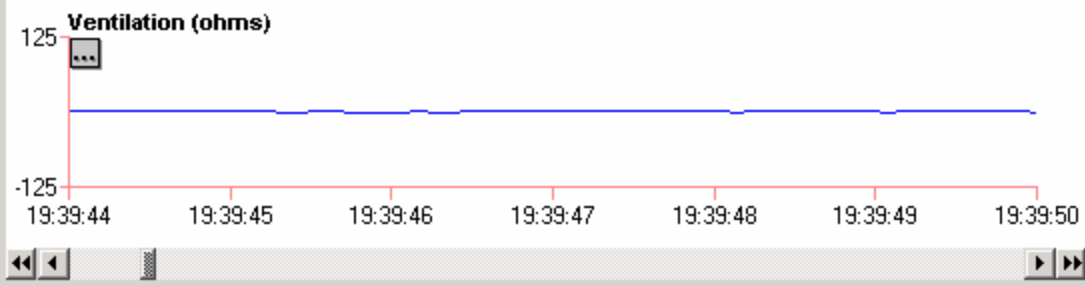
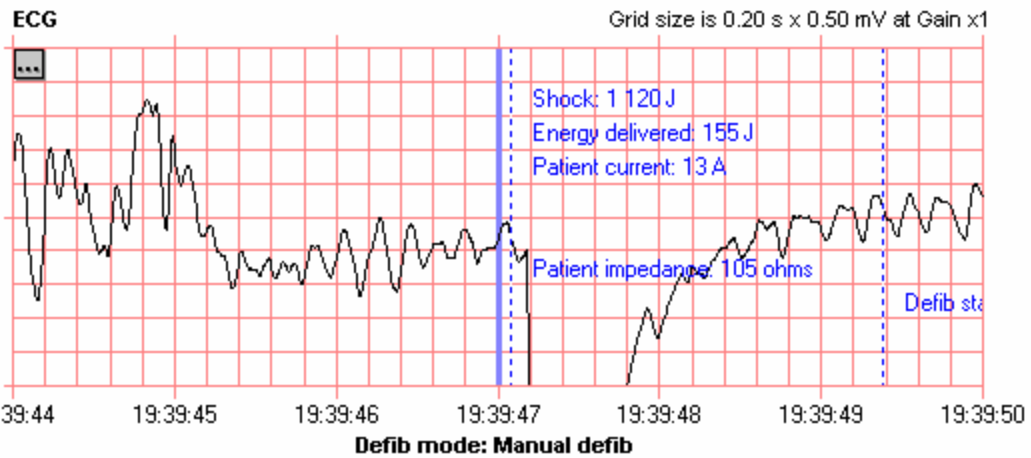
3011371-124 LP1213107735

Device	Device ID	New	Report	*	Time Adjust...	Time	Elapsed Time	Event Type	*	Note	HR	SpO2*PR	EtCO2(mmHg)*RR	NIBP(mmHg)*PR	P1(mmHg)	P2(mmHg)
LP12	Unknown	⊗	Continuous Complete	🚫🔴	00:03:24	21:35:25	00:13:09	Print 4	🟢		105	--*				
LP12	Unknown	⊗	Start Trend Data		00:03:24	21:36:00	00:13:44	NIBP	🟢		106	96*108		142/80(102)*106		
LP12	Unknown	⊗	Initial Rhythm		00:03:24	21:36:55	00:14:39	Print 5	🟢		185	97*181				
LP12	Unknown	⊗	Print 1		00:03:24	21:37:14	00:14:58	V#2 Sign	🟢		213	97*174				

1 - General 2 - Entire ECG 3 - Magnified ECG 4 - CPR Analysis 5 - CPR Quality Calculation 6 - 12-Lead



NIBP mmHg ---	CO2 mmHg ---	SpO2 %	ECG x1 MFC 151
---------------------	--------------------	-----------	----------------------

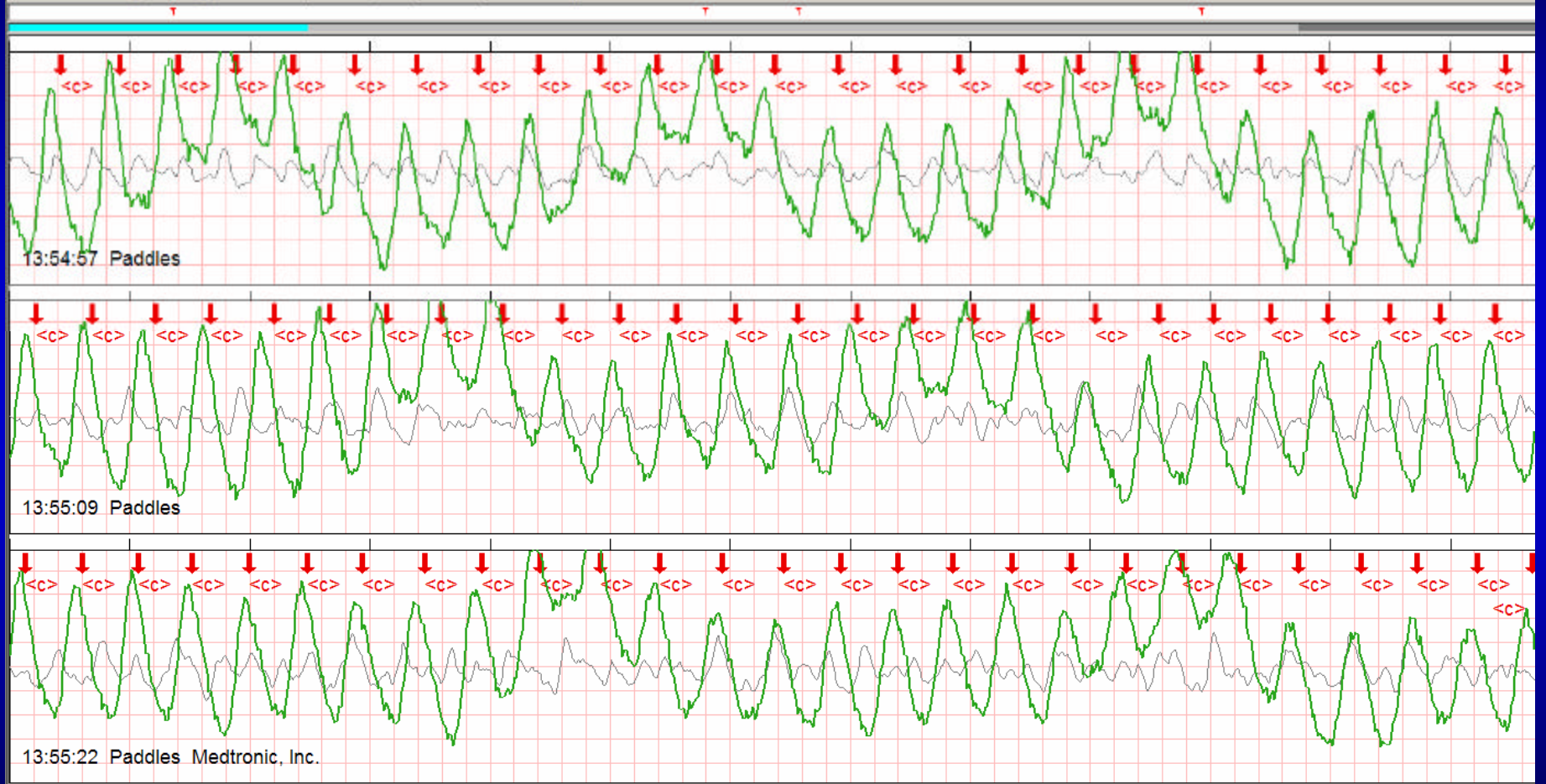


Waveform View

File Edit View Help

25.0mm x1.0 3 0.07.51 0.40.17 0 4

Show CPR Events <C> <V> <Initial Rhythm> <BOE> <TOE> <FD5C> <End FD5C>

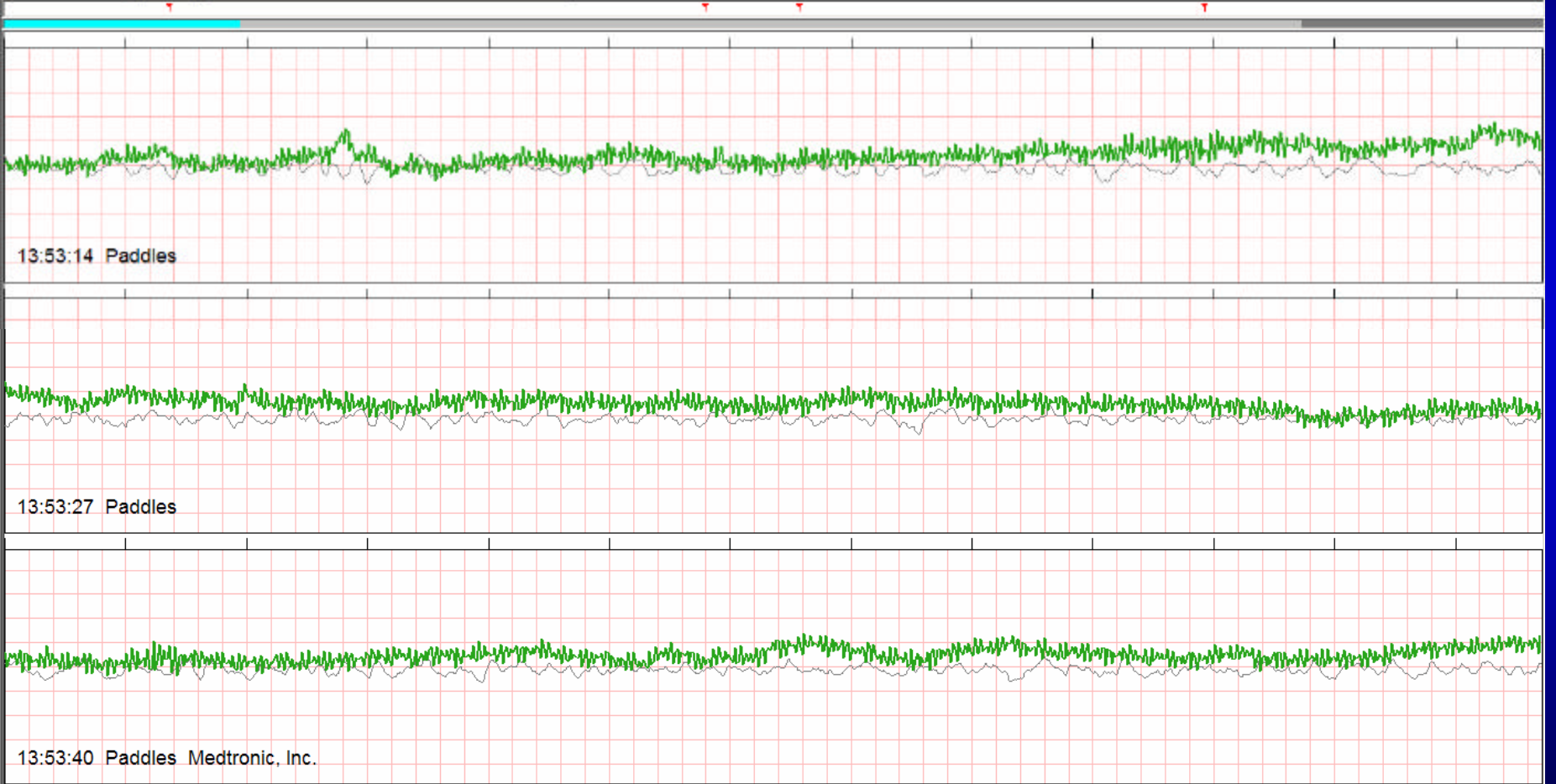


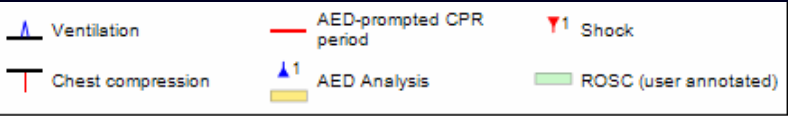
Waveform View

File Edit View Help

25.0 mm x1.0 3 0.05:08 0:40:17 0 4

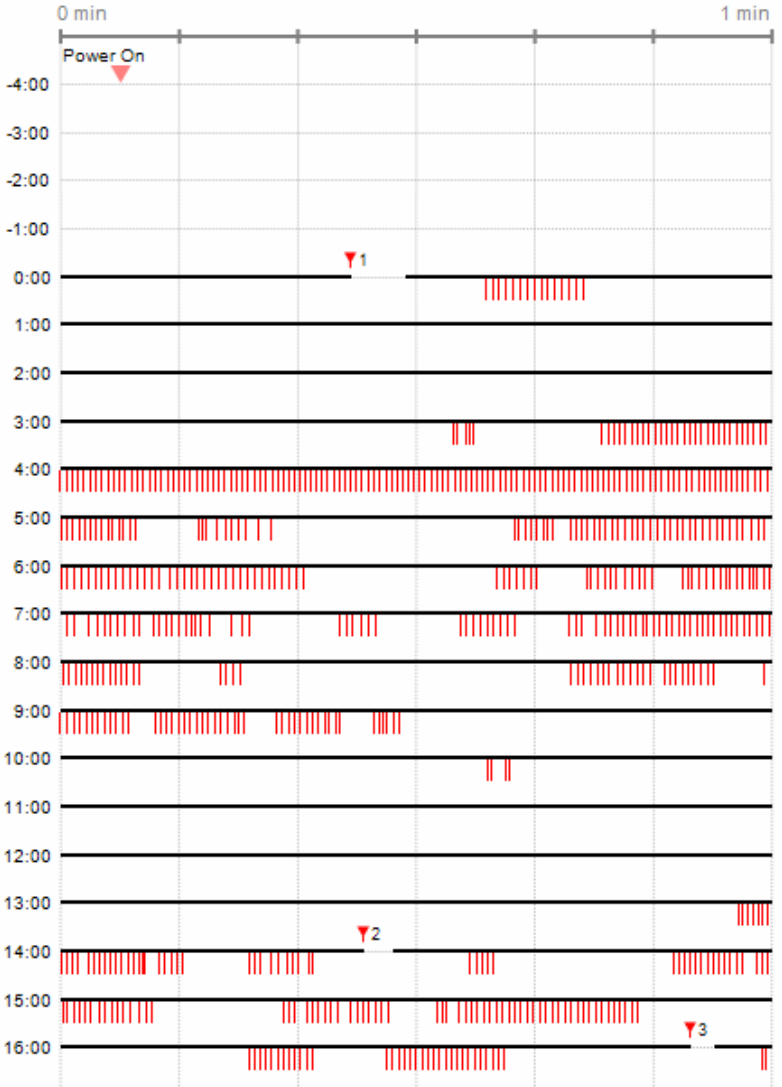
Show CPM Events: <CP> <CV> <Initial Rhythm> <BOE> <TDE> <ROSC> <End ROSC>





CPR QUIK-VIEW

Interval Statistics



CPR Ratio, %	Prompt. CPR Ratio, %	Compr. Ratio, %	Prompt. Compr. Ratio, %	Compr. Rate	Compr. /min
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
--	--	--	--	--	--
17	--	17	--	102	16
--	--	--	--	--	--
--	--	--	--	--	--
29	--	29	--	122	34
100	--	100	--	124	123
67	--	60	--	113	63
75	--	69	--	103	69
100	--	73	--	109	70
55	--	40	--	116	42
49	--	49	--	117	45
5	--	5	--	--	4
--	--	--	--	--	--
--	--	--	--	--	--
5	--	5	--	148	7
58	--	50	--	123	54
66	--	61	--	116	64
40	--	31	--	123	36

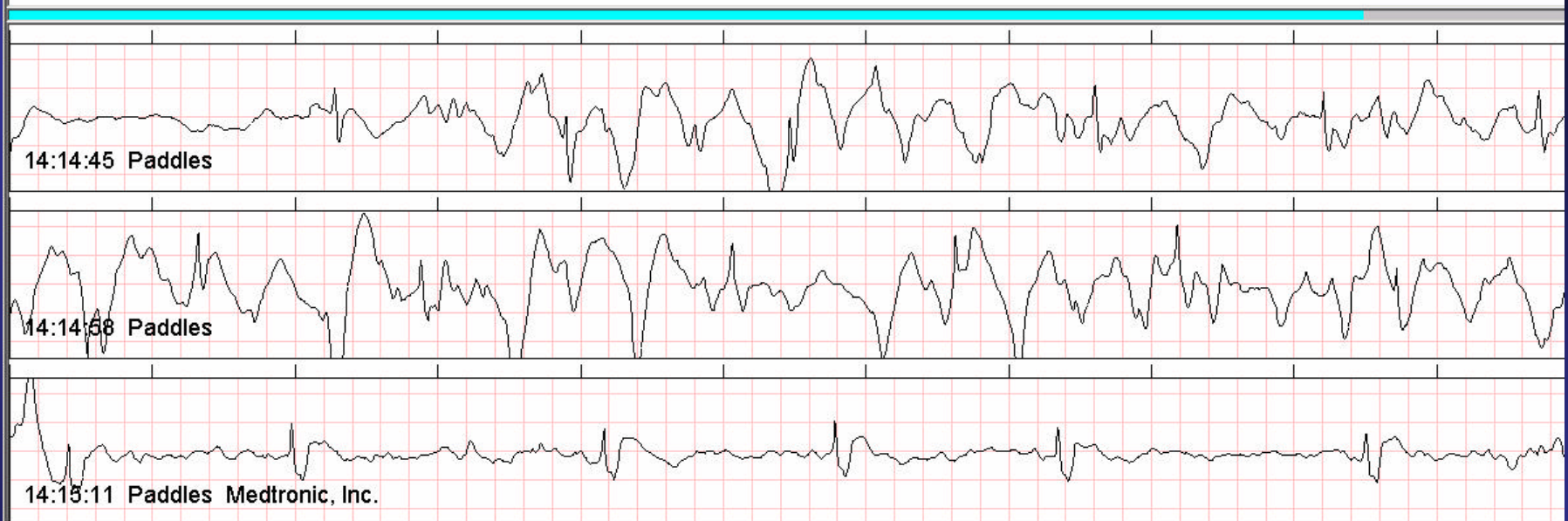


LIFENET Case View - Waveform View

File Edit View Help

25.0 mm x1.0 3 0:29:46 0:39:58 0 0

Show CPR Events <> <v> <Initial Rhythm> <BOE> <TOE> <ROSC> <End ROSC>



Device	Device ID	New	Report	*	Time Adjust...	Time	Elapsed Time	Event Type	*	Note	HR	SpO2*PR	EtCO2(mmHg)*RR	NIBP(mmHg)*PR	P1(mmHg)	P2(mmHg)
LP12	M132	⊗	Continuous Complete	🚨🔥	00:00:09	13:44:59	00:00:00	Power On	🟢							
LP12	M132	⊗	Initial Rhythm		00:00:09	13:46:04	00:01:05	Initial Rhythm	🟢			--*	--*			
						13:49:57	00:04:58	Vital Signs	🟢		169	--*	--*			
						13:54:52	00:09:53	Alarm Apnea	🟢		52	--*	--*			
						13:54:57	00:09:58	Vital Signs	🟢		62	--*	--*			
						13:57:26	00:12:27	Alarm Apnea	🟢		76	--*	17*6			
						13:59:26	00:14:27	Alarm Apnea	🟢		149	--*	8*9			
						13:59:57	00:14:58	Vital Signs	🟢		35	--*	7*0			
						14:02:33	00:17:34	Alarm Apnea	🟢		33	--*	8*10			
						14:03:10	00:18:11	Alarm Apnea	🟢		101	--*	23*0			
						14:04:20	00:19:21	Alarm Apnea	🟢		89	--*	76*21			
						14:04:57	00:19:58	Vital Signs	🟢		116	--*	4*0			
						14:09:57	00:24:58	Vital Signs	🟢		113	--*				
						14:13:25	00:28:26	Alarm Apnea	🟢		162	--*	17*42			
						14:14:57	00:29:58	Vital Signs	🟢		67	--*	72*12			

Synthesis



The shortest book ever written:

*Promises kept by
hardware and
software vendors*



**Make SURE that you
see the equipment and
software running,
AS PROMISED,
BEFORE you buy it!**

The Job of I.T. People is to say “NO!”



Imagining what COULD be is not necessarily in their line of work

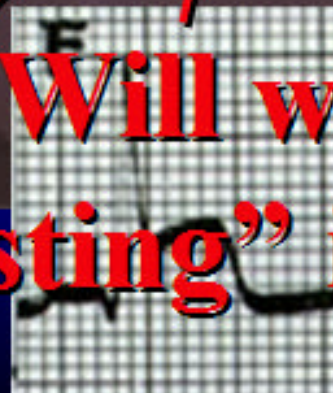
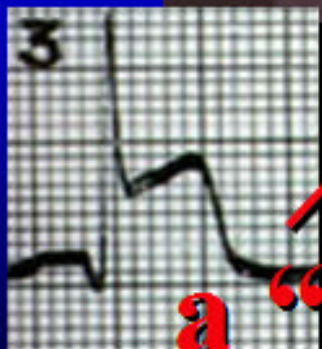
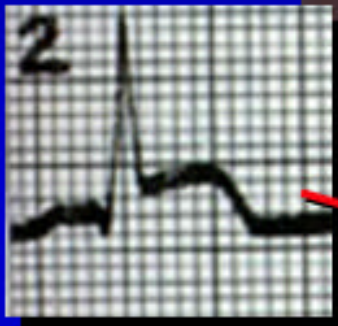
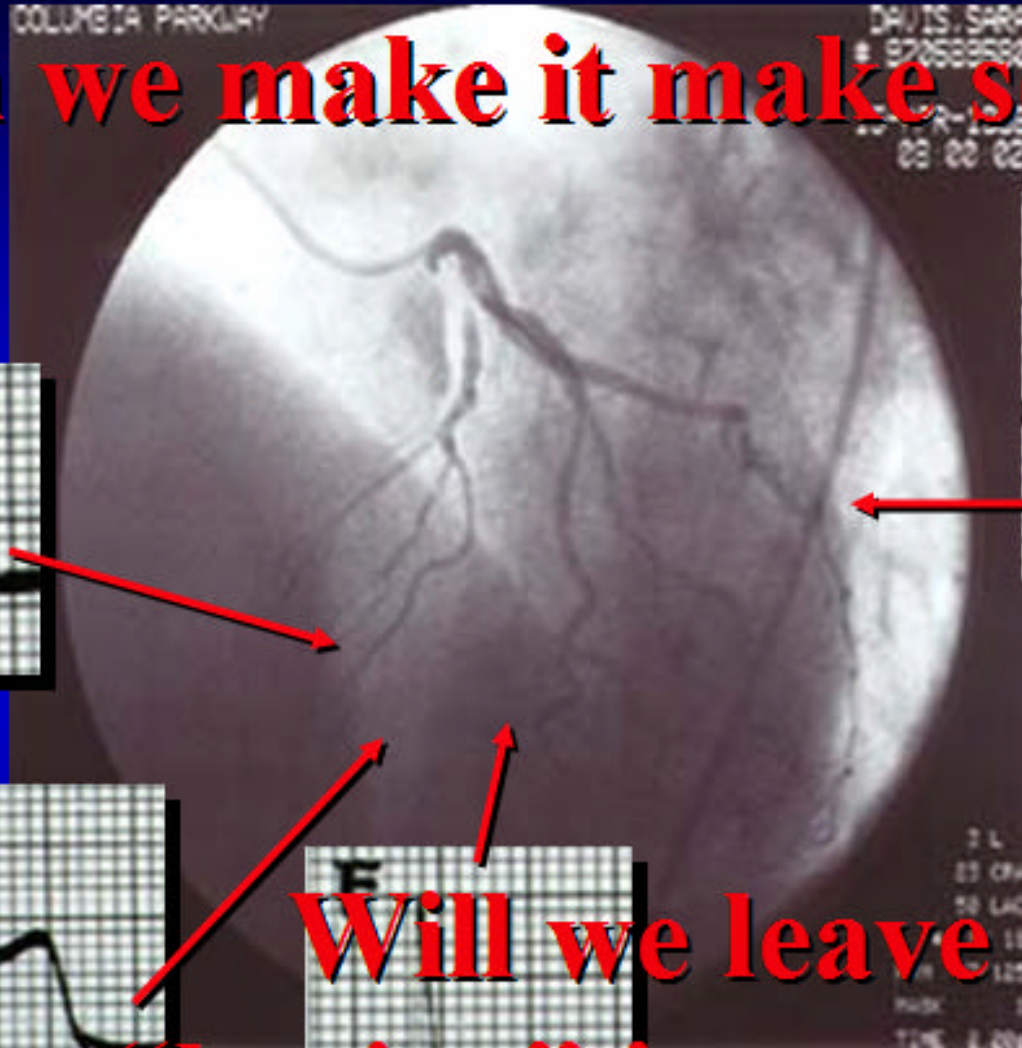


Whining about the problem
doesn't work

**Legacy Systems
will always be
a problem, requiring
“work-arounds”**



Can we make it make sense?



Will we leave a “lasting” impression?

A sunset scene with several parachutes and silhouettes of people descending. The sky is a mix of orange, yellow, and red, with the sun low on the horizon. Several parachutes are visible, some fully deployed and some still in the process of opening. Silhouettes of people are seen against the bright background of the sun.

www.uts.w.w.s

www.rayfowler.com

Questions?
Comments?
Eruclatations?

