UPAMDTM/P1823TM
Potential Goals
Updated 7/10/10

Reflector input Update/Bob Davis
UPAMDTM acting Chair
UPAMD™ Goals

• General Goals
• Connector Goals
  – Connector Options
• Communications Goals
  – Communications Options
• Power Goals
  – Power Options
UPAMD™ General Goals

• Life expectancy of 10 years, hopefully more
• Same connector for All device and adapter connections
• Power range >10W – 130W delivered power to device and is brand, model, and year agnostic
• First adapter must work with last device and last adapter with first device. Standard Compatibility.
  • Adapter<->Mobile Device communications required for higher power safety.
  • Continuous communications growth to support growth of UPAMD capability.
• Must support regular non-battery and battery powered devices
  – Basic power delivery mechanism
  – Make independent of rapidly changing technology
  – Multiple battery technologies currently used – no common adapter or battery voltage
  – Consider isolation to meet medical power needs
• Standard designed to support Certification testing of adapter and device
• Consider future mobile device design options
  – Smaller profiles, headed for 10mm to 5mm? Different shape devices, non-edge usage
• No DANGEROUS power without communications.
• Device may be a source or sink of power
  – To supply power other devices beyond the USB power range of <10W.
  – Able to share power for mission critical or business critical applications
• Connector must not mate with any current designs – product Safety issue – no confusion
• Apply KISS principle – Keep It Simple Stupid within the other goals.
• Environmentally friendly to eventual disposal
UPAMDM™ Connector Goals

• Capable of >10W to 130W No conflict with USB based 5V power delivery systems
  – Contacts rated for currents to 9A?. Voltage Rated SELV?.
• Not compatible with any existing connector design
  – Equipment safety - Prevent damage – new starting point
• Easy disconnect AND cable retention capability in same common connector design
  – Easy disconnect to prevent tripping in office/home environment – health and safety issue
  – Strong retention capability for rugged high acceleration environments - car/boat/airplane/mission-critical
• Floating electrical connection, electrically isolated – Safety
  – No shock hazard under any conditions - meet medical isolation requirements
• Very high connect – disconnect life cycle capability – Many year usage
• Support lower profile devices
  – 10mm or less? iPad=13.4mm (to start with) 5mm or less goal
  – other shapes and possibly flat surface connect
• Watertight or Water resistant
  – To keep coffee, tea, rain, adult beverages, out of the connection.
  – Seal on cable side of connection for easy replacement of cable or seal.
• Positive and Negative connection with communication AC coupled
  – Assume redundant contacts for reliability and current sharing?
• Aesthetically pleasing
• Retention mechanism - Magnetic or Mechanical
  – Several clip possibilities exist. New Ideas clearly welcome
• Blind mate friendly - it possible
  – think of mating adapters and device alignment by feel in the dark
  – Easy docking station or charging station operation
UPAMDM™ Connector Goals (Continued)

• Separate Power Cable capability
  – Same connector on each end – adapter and device
  – Buy cable to meet length need
  – Reduce adapter cost – consumer buys UPAMD cable(s) to meet needs
  – Possible quick interface to join two cables
  – One adapter could support multiple cables/devices
    • Cut down total number of adapters for desk top use. Each socket on adapter independent.

• Support device to device power charging or power sharing
  – Support for mission-critical and business-critical applications
  – Borrow power needed to watch the end of the movie
  – Software only modification to protocol
  – Power sourcing optional for device

• User replaceable power cable
  – Most damage is to connectors and cables, replace as needed
  – Change cable to adjust length needs
  – Carry/borrow backup cable
UPAMD™ Connector Options

- **Barrel Connector – TC100 proposal**
  - **Advantages**
    - Exists, History, IEC 61076-2-102 spec, cost?
  - **Disadvantages**
    - Big, No sources found, Safety trip hazard, connector damage history

- **Spring Loaded Contact Style – Cable side**
  - **Advantages**
    - Small Footprint, flat device contact surface, good usage models, low cost to device, possible Flush mount on device, aesthetically pleasing, contact life >1,000,000 operations, easy connector to connector adapter for extension cable.
    - Can be symmetrical on cable and device/adapter
    - 42mil dia pin = 2Amp cont. 50mil dia pin = 9Amp cont.
  - **Disadvantages**
    - Latching/retention mechanism, required to overcome spring pressure 300-500+ grams

- **Edge Connector**
  - **Advantage**
    - Direct extension of pc board, low cost edge connector
  - **Disadvantages**
    - Direct access to pcb, moisture seal, contact life

- **Multi-pin Connector**
  - **Advantages**
    - Separate power from control on different wires
  - **Disadvantages**
    - Cost, single orientation, connector life cycle count

- **Magnetic Induction coupling**
  - **Advantages**
    - No contact coupling, no penetration of casing, cleanest design.
  - **Disadvantages**
    - Size of coil, position for good coupling. Field effect on surrounding parts at 130W, power transfer efficiency, modulation for communications. Interference with other radio traffic from device.

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Device has flat contact – cable "Pogo" style spring-loaded pin
Pin 1 and 5 Negative connection
Pin 2 and 4 Positive connection
Pin 3 charge control – shorter pin = last make
Communication AC coupled to positive and negative wires

10 July 2010

UPAMDP-1823 Goals - Bob Davis
UPAMD™ Communication Goals

- Use existing standards if possible.
  - CAN bus, RS422/RS485, USB, others?

- Differential signal communications
  - AC coupled on positive and negative power leads
  - Robust system – EMI, EMC, ESD

- Other communications schema?

- Possible symmetrical operation
  - Allow device to source other devices
  - Allow power sharing to keep critical devices working in emergencies -- adaptive UPS
  - Software controlled

- No communications = how much power?
  - Device startup for regular non-battery powered devices
    - Provide nominal 12-14V at <0.5A until communications established
  - Device startup for low battery
    - Must assume device protects itself at low end of battery to retain restart capability.
    - Restarting safety circuits is very battery and safety circuit specific. Battery failures require new battery/external charge
  - No shock hazard, power source protects self

- Communications messages needed (starting thoughts -- extend for symmetrical operation)
  - “Any adapter present?” (probably connector pin)
  - “Who are you?”: To adapter or other device/source
  - “I am ___and my capability is ___ max available power is ___ watt/hours”: to device/load
  - “Supply power XX Volts YY mA max”: to adapter/source
  - “Ready” or “not capable” : to device/load
  - “Start power”: to adapter/source
  - “Status?”: to adapter/source
  - “Status is ____”: to device/load
  - “STOP power supply”: to adapter/source
UPAMD™ Communications Options

• Signaling
  – Extra wires with transformer/capacitive coupling for isolation – Ethernet/LVDS style
  – Differential signals AC coupled to positive and negative power leads

• Protocols
  – CAN Bus
    • Advantages
      – Known protocol, very flexible, designed for control structures
      – Most small embedded controllers have it built-in
      – High growth potential
      – Used in industrial and vehicular control systems – Noise issues well addressed
    • Disadvantages
      – Less well known
  – UART – RS422/RS485
    • Advantages
      – Low cost. Easy implementation, can support needed communications.
    • Disadvantages
      – Needs UART from host
      – Protocol development needed.
  – USB
    • Advantages
      – Ubiquitous, well known, many ports available.
    • Disadvantages
      – USB certification for modified protocols
      – Requires cooperation with USB-IF committee
      – Operation over differential power lines needs to be verified.
  – Ethernet – Ethernet over power-line method (P1901)
    • Advantages
      – Proven to work, also can connect for other communications
    • Disadvantages
      – Needs additional Ethernet port
      – Most expensive.
  – I2C/SMB; SPI; 1-Wire – probably difficult to implement and noise sensitive
  – X-10 – not designed for DC – other pulse derived communications possible.
UPAMDM Power Goals

• One connector meets all power needs
• Power Range >10W – 130W
• New Connector – Not inter-mateable with existing connectors – Safety issue for equipment and people
• Positive rail and Negative rail
• Floating connection, not grounded at adapter
  – Isolation (leakage) sufficient for medical applications?
• Device to Device to share power if needed
  – Possibly support powering one device from another
    • Higher power version of USB power option with smart control
    • Power sharing in mission and business critical situations.
• Smart interconnect.
  – Higher power enabled through communications between devices
• Regular non-battery and dead battery devices need starting power?
  – Supply 12-14V at <0.5A without communications for startup
  – Higher power requires communications and software control
UPAMDTM Power Options

• 10 year Life Expectancy
  – Think ahead – All devices will immediately transform input power into internally needed voltages based on technology used.
  – Consider both as a fixed power source and as battery charging source - basically power transfer

• Adjustable power Source
  – Adapter/source sets output voltage based on communications with device/load and its capabilities
  – Adapter/source sets maximum current limit based on communications with device/load and its capabilities
  – Good match for each user
  – May need starting voltage such as 12-14V @ <0.5A for starting
  – Specify range from 12V to 45V. Power limited by connector current capacity.
    • Use of 9A rated 0.050 spring loaded contacts with 2 per rail provides good margin to 130W above 15V.
    • Possible options 12-14V, 20V, 24V, 36V, 42V, 48V. Power precision +/- 10%?
    • Possible current limits: 1A, 3A, 5A, 10A. Or at specified mA rating 0-10000.

• Semi-regulated bulk power
  – Bulk power ie 24V +/- 10-15% (6+A) or 45V +/- 10-15% (3A) @ 130W
    • Power delivery vehicle with point of use regulation
    • Regulator efficiency works
    • Lower Cost
    • Smaller wire size needed
    • Longer power cable allowed.
    • Higher voltage more efficient transfer.
    • Higher voltage smaller contacts.

• Well regulated Fixed voltage
  – Tight regulation +/- 5% DC @ fixed voltage
    • consider cable losses and feedback loop – more expensive
    • Battery chemistry driven voltage
    • No common voltage used.
      – 12V, 13.75V, 15V, 18.5, 19V, 19.5V, 24V now with some up to 48V SELV limited
      – Battery chemistry – NiCad, NiMH, Li-ion, Li-PO other exotics. New technology will probably be different
      – All devices seem to have internal regulators.
    • Battery voltages – laptops
      – 11.1, 10.8, 14.8, 9.6, 14.4, 12,......
Backup Slides