Soaring Avionics For Idiots/Dummies "Made Easier"

Soaring Electronics

To Be Covered

- Global Positioning System (GPS)
- Flight Recorders
- Flight Computers
- Personal Digital Assistants (PDA)
- Communications Wiring
- Power Wiring

What's in your cockpit?

…just the "basics"?

…a flight "recorder" only?

…a flight "computer"?

…GPS navigation?

What's in your cockpit?

…just the "basics"?

…a flight "recorder"

…a flight "computer"

…electronic navigation

To Be Covered

What is needed for Badge & Contest Flying?

Required

- Declaration before flight
- Flight Types & Proof
  - Altitude – [illegible] you claim
  - Duration – [illegible] you were flying as long as you claim
  - Distance – Prove you made the turnpoint(s) you claim.

Requirements

- Non-Electronic
  - Task Declaration
  - Official Observer (always)
  - Barograph (altitude, duration)
    - Calibration required every 1 year
  - Camera/Film (distance)

- Electronic
  - Task Declaration
  - Official Observer (distance only)
  - Flight Recorder (all categories)
    - Calibration required every 2 years

Electronic Badge & Contest Flying

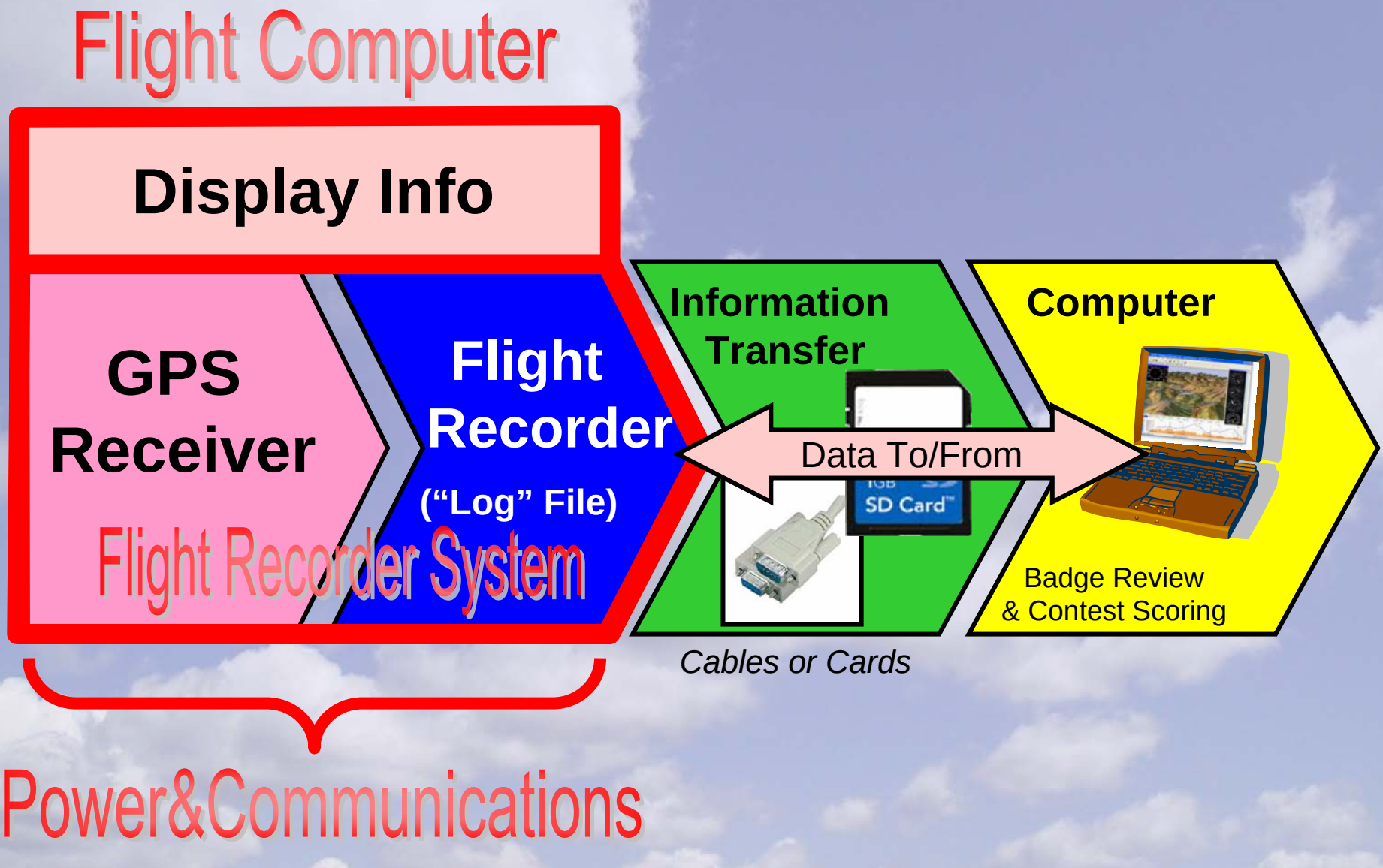
Required

- Declaration before flight (distance)
- Secure logging of the flight with lat/long and pressure altitude

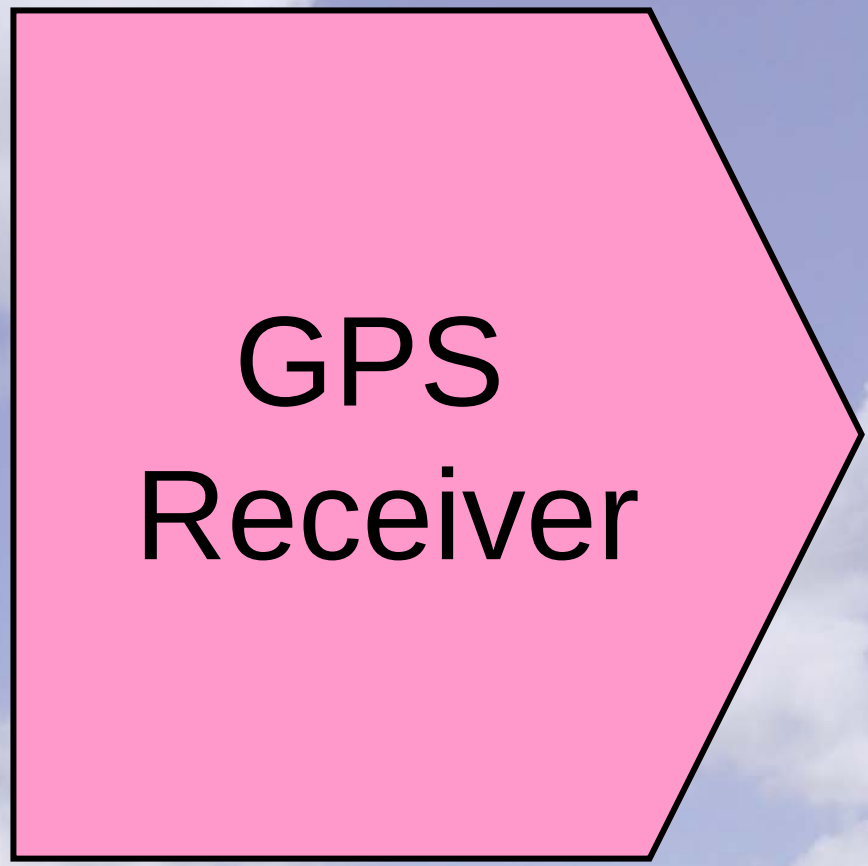
Optional

- A database of turn points
- Method to track task(s)
- Navigational information (map)
- Soaring information

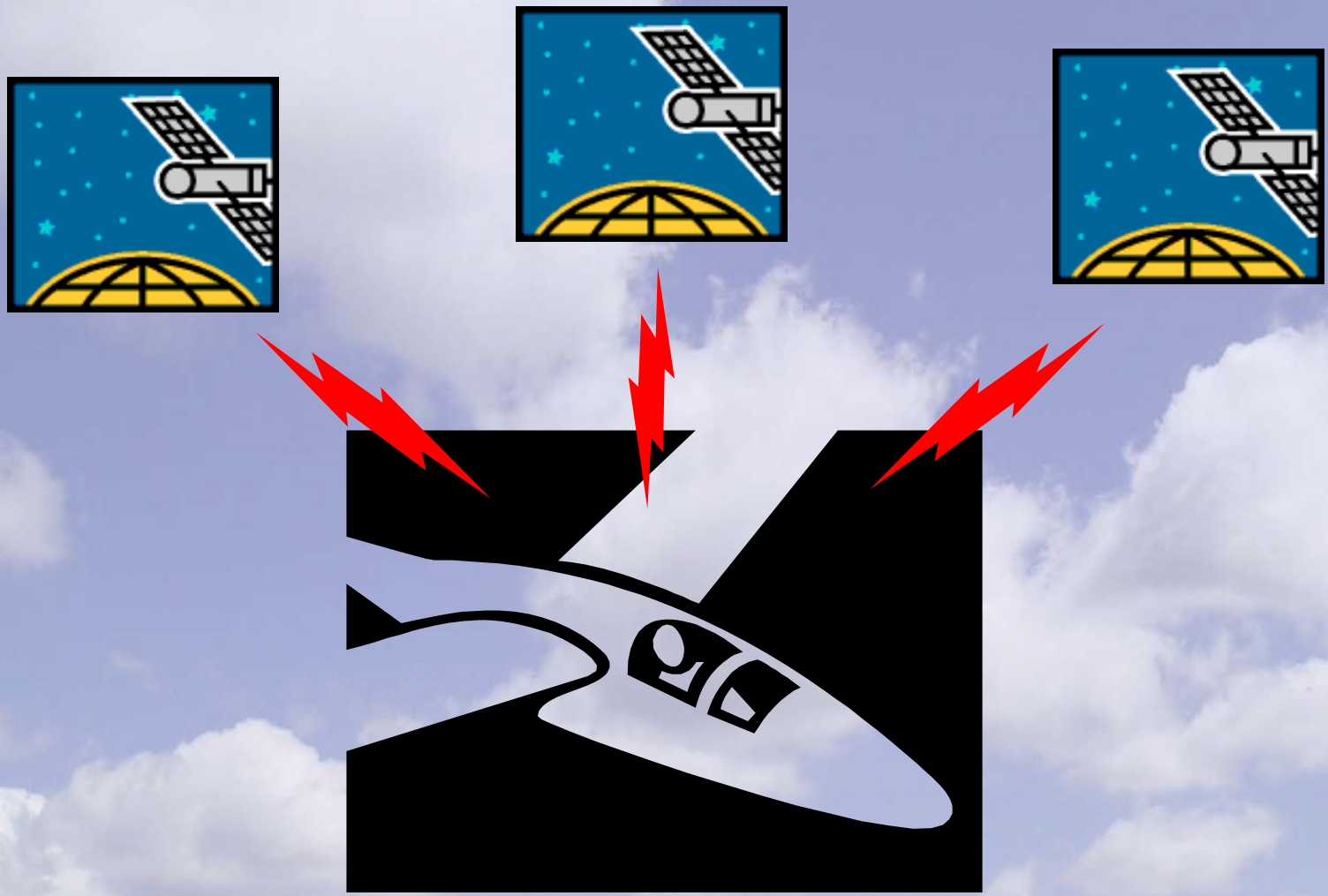
The Basic Parts



The Basic Steps



What is GPS?

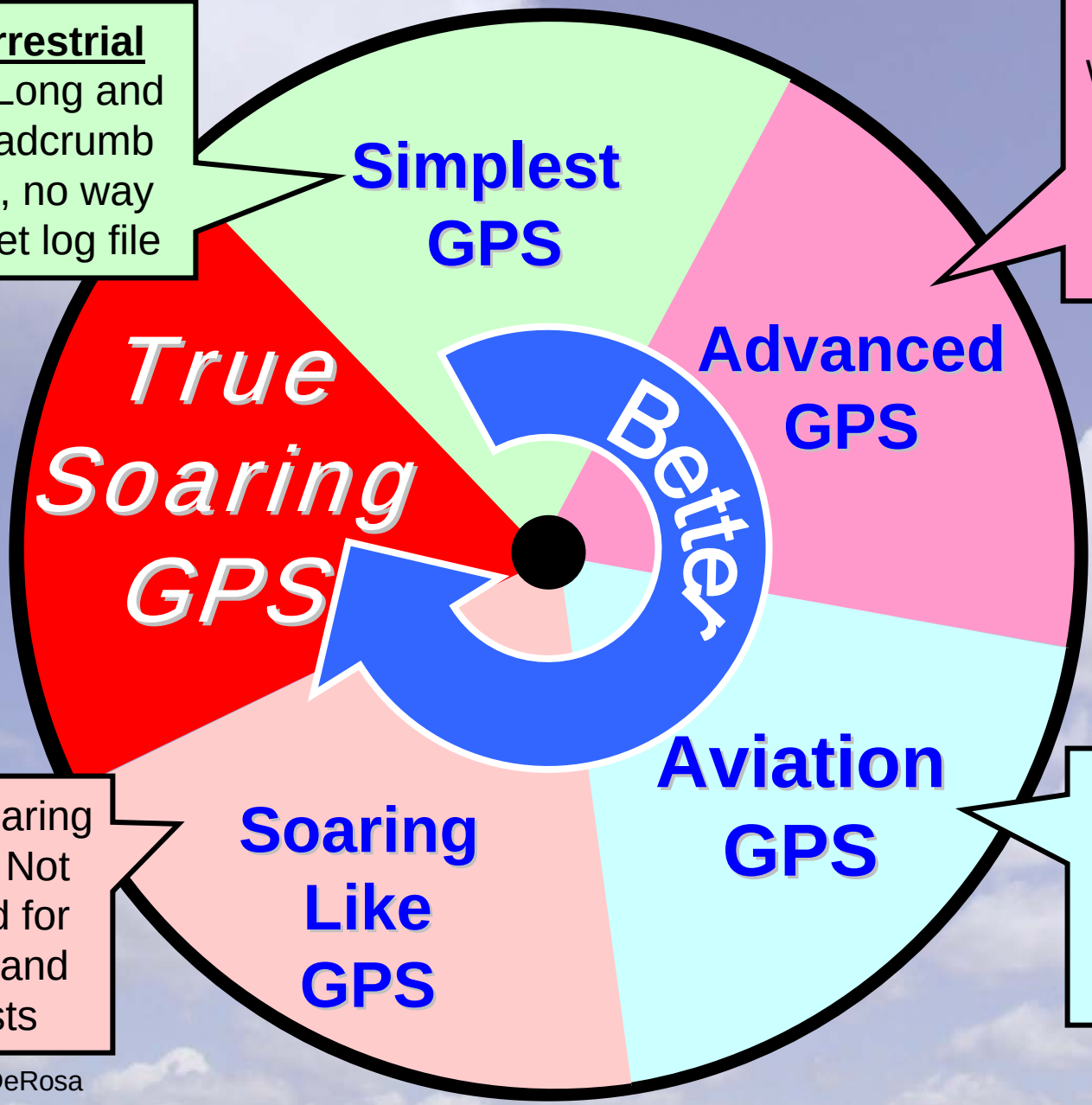


What is GPS?

- Constellation of 24 satellites orbiting at 12,000 miles above the earth sending satellite number and accurate time/date.
- Computer calculates latitude, longitude, speed, altitude from satellite info.
- Accuracy depends on the number of satellites you can “see”.
  - 3 Satellites - 2-D Lat/Long Fix only
  - 4 or more Satellites - 3-D Lat/Long + Altitude Fix*
  - 5-7 Satellites typically seen
  - Best accuracy ~5-15 meters (~16-50 feet)

* Required for badge and competition

Categories of GPS Devices



Terrestrial
Lat/Long and breadcrumb trail, no way to get log file

Handheld
with terrestrial navigation database, logging & downloading

Other Soaring Sports. Not intended for badges and contests

Aviation
database but not Soaring oriented

Aviation GPS

- Aviation database, speed and accuracy but not Soaring oriented

http://garmin.com

* Log file not valid for badge and competition

Non-Soaring

http://brauniger.com

http://digiflyuk.com

http://flytec.com

http://www.aircotec.ch

For
Power Parachutes,
Hang Gliders,
Balloons,
Ultralights,
Parafoils

*Some systems have FAI logging**

* Log file not valid for badge and competition unless FAI certified

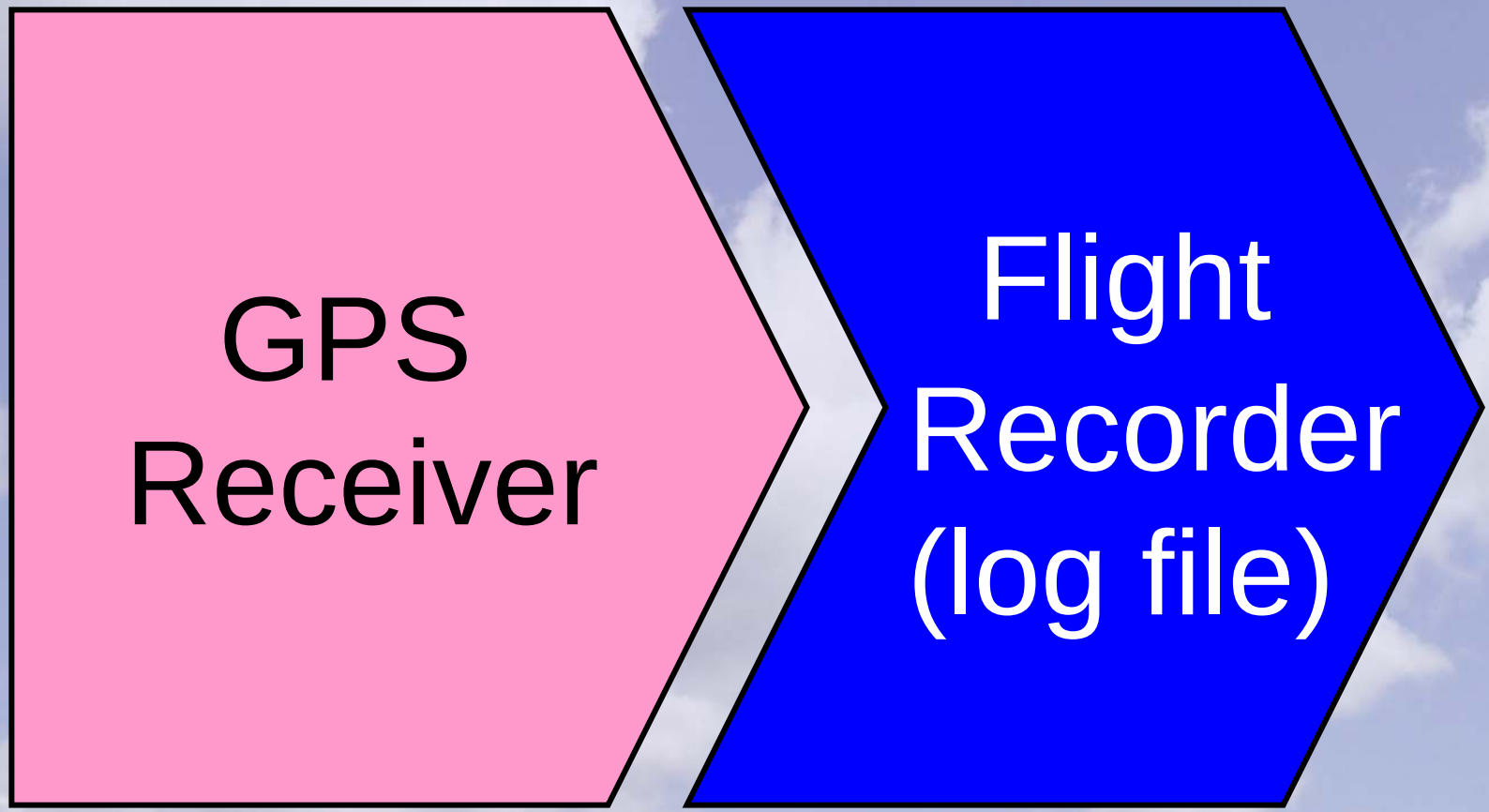
Positional Information

- Global Positioning System (GPS) receivers can be found in;
  - Standalone Devices
  - Personal Digital Assistants (PDAs)
  - Soaring Flight Devices
    - Flight Recorders
    - Flight Computers

Global Positioning Systems (GPS) Soaring Devices

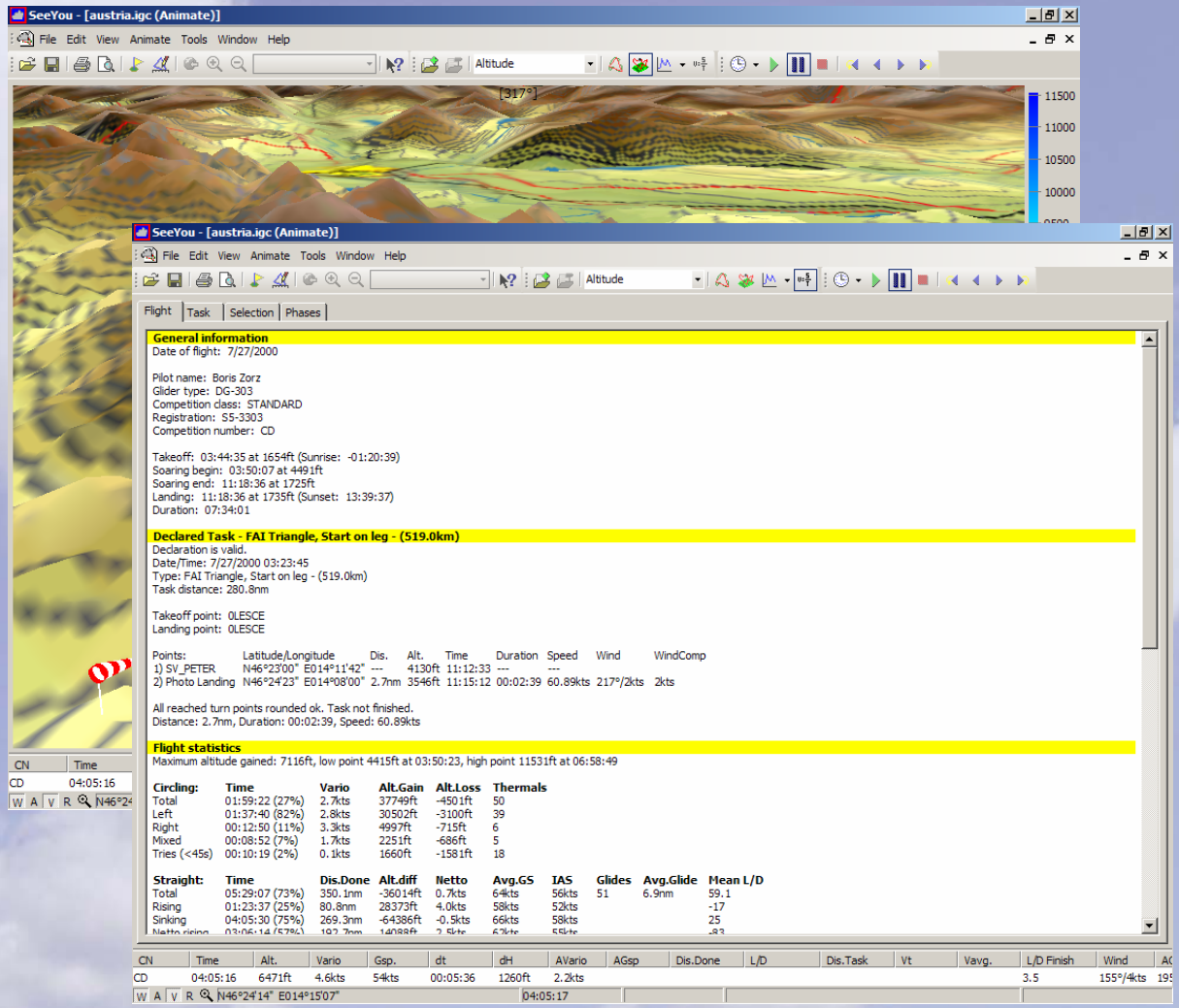
- Soaring Flight Recorders - GPS
- Soaring Flight Computers - GPS plus display for navigation & soaring
- **FAI Certified log files**

Soaring Flight Recorders



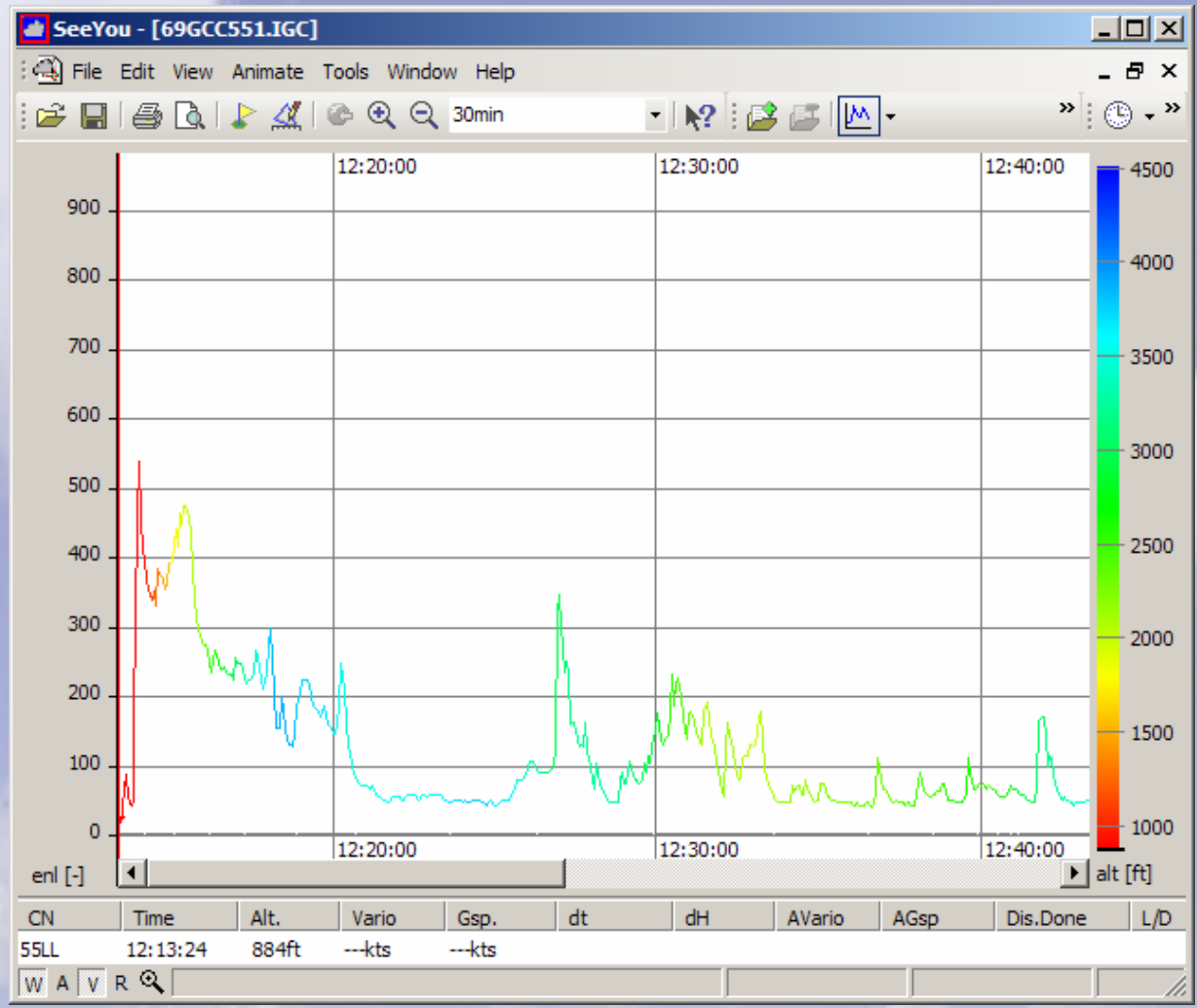
Flight Logs

- Proof for Records & Contests
- Analysis of Flights



Motorglider Engine Noise

- Proof that engine was not used
- Only available on some recorders



Feature not available or optional on all recorders

Flight Logs Types

- **Unofficial** flight logs
  - Any GPS Device that can log
  - Non-secure data files
  - May be used in some regional contests. Ask first!
  - Cannot be used for SSA/FAI badges & records

- **Official** flight logs
  - Secure IGC (GPS) Files
  - Devices must be approved by FAI for sanctioned events

Standalone Flight Recorders

A standalone recorder only needs;

1) Power (Internal or External)
2) GPS Antenna
3) Secure Mounting

PDA + GPS

- Soaring oriented
- Very portable
- Aviation database
- **Log file not legal for badge and most competitions**
- Specialized Software
- Easily moved between gliders

* Log file not valid for badge and competition

Calibration

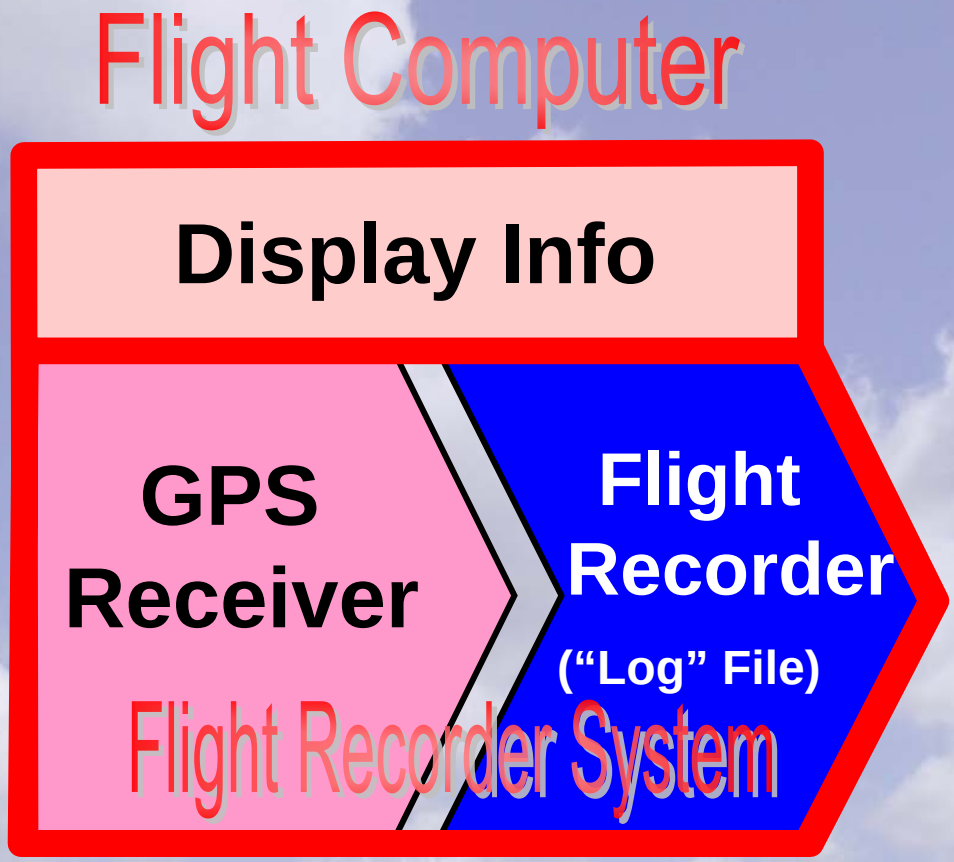
- **Flight Recorders** pressure altitude sensor must be calibrated by a certified technician every 24 months for badges and records or 4 weeks **after** flight (non-records)

Cambridge 302A


Cambridge 302

Barographs must be calibrated every 12 months

Soaring Flight Computers



Flight Recorders vs. Computers

- **Flight Recorders** receive GPS information and record (log) your flight for later download

- **Flight Computers** flight recorder + display of other function (i.e. GPS, variometer, altitude, speed to fly, final glide, tasks, turnpoints, etc)

- **Both** device types often can send GPS information to other devices (e.g. PDA)

PDA Based GPS Systems

- Hewlett-Packard IPaq is the “standard” PDA for soaring
- Specialized software
  - Free or for Pay
  - Tasks, thermal and final glide info
  - Moving Map display
- No external static, total energy or air speed inputs
- No variometer information
- **No or Unofficial log file**
- Uses GPS information
  - Calculate position, thermal history, final glide, winds aloft, etc

General Purpose GPS*

* Log file not valid for badge and competition

Standalone Flight Computers

Official FAI Log Files

A standalone computer only needs;

1) Power (Internal or External)
2) GPS Antenna (clear view of sky)
3) Secure Mounting and…
4) Must be able to see it!

Flight Computer Systems

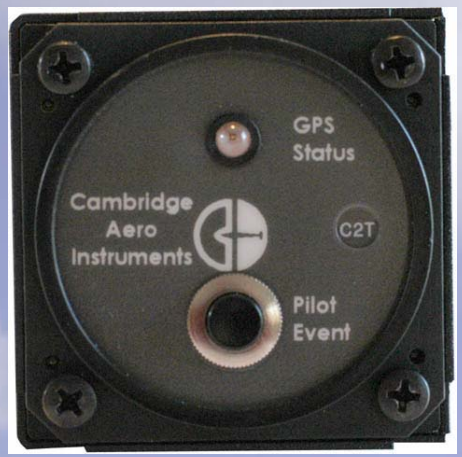
GPS & Flight Recorder Only

Flight Computer Systems

GPS & Flight Recorder Only

Flight Computer Systems

GPS & Flight Recorder Only



Cable

Display

Flight Computer Systems

Flight Computer/GPS/Variometer

Cable

Text navigation display
Task Input

Flight Computer Systems

Flight Computer/GPS/Variometer

Cable

Text navigation display
Task Input

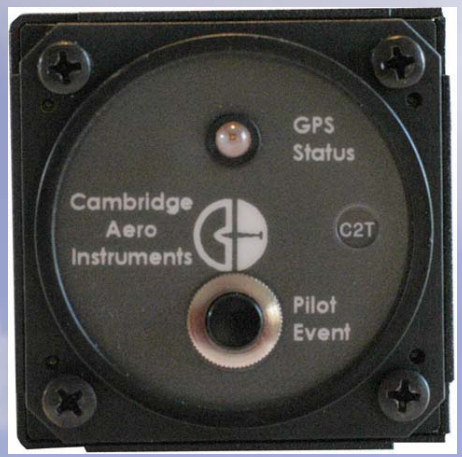
Cable

Repeater for Rear Seat

PDA Based Systems

Personal Digital Assistant (PDA)
Moving Map Display

GPS & Flight Recorder Only



Cable

PDA Based Systems

Personal Digital Assistant (PDA)
Moving Map Display

Flight Recorder/GPS/Variometer

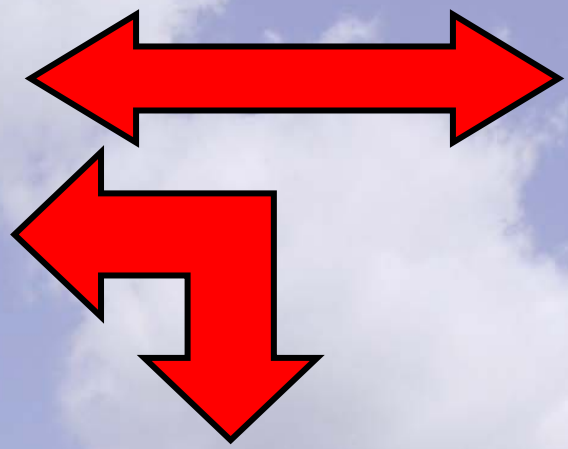
Cable

PDA Based Systems

Personal Digital Assistant (PDA)
Moving Map Display

Flight Recorder/GPS/Variometer

Cables



Advantage!
Two Task Displays!

Flight Computer Systems

Single piece GPS, flight recorder and
text navigational display

Personal Digital Assistant (PDA)
Moving Map Display

Cable

Flight Computer Systems

Personal Digital Assistant (PDA)
Moving Map Display

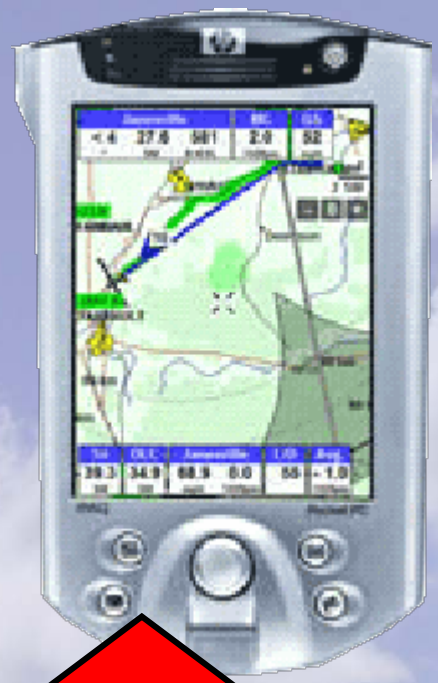
Cable

Needs external power

Flight Computer Systems

GPS & Flight Recorder Only

Personal Digital Assistant (PDA)
Moving Map Display



Advantage!
Two Task Displays!

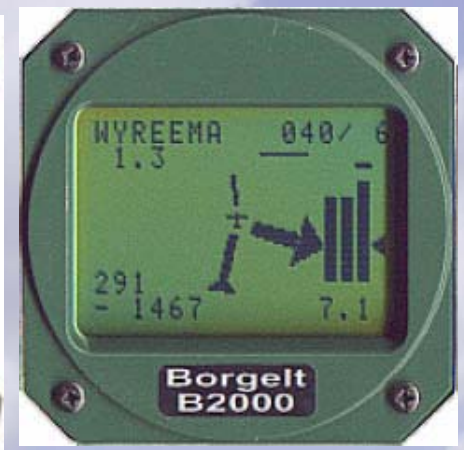
Single flight computer
and graphical navigational
display

Cable

Cable

Contains a recorder but <u>not</u> IGC approved

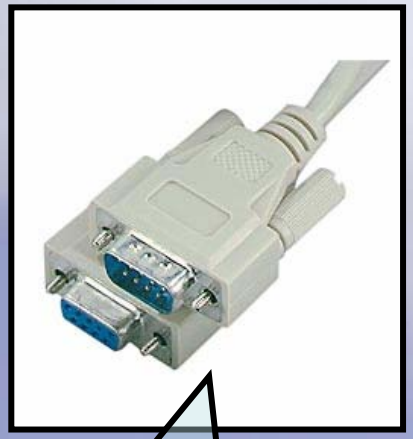
Flight Computer Systems



Connections

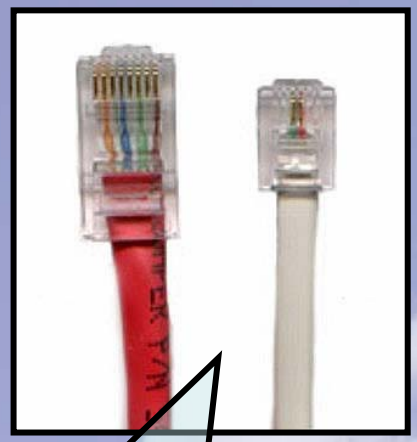
Power & Communications

Connector Types (Power, Communications)



"DB"
DB-9 (9 pins)
DB-12 (12 pins)

Universal Serial Bus "USB"
Always 4 pins



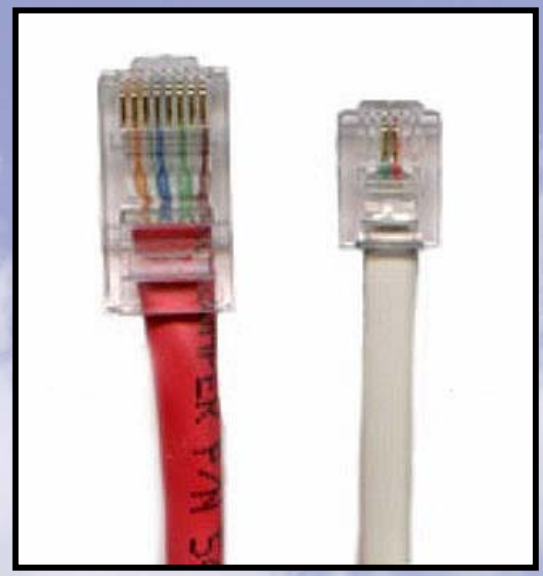
"RJ"
"Telephone"
RJ-11 (4 pins)
RJ-45 (8 pins)

Those Pesky "Proprietary" Connectors!

Serial Communications

DB-9 Connector

Serial Communications



RJ-45 & RJ-11 Connectors

Serial Communications

USB
Connectors

Serial Communications

PDA Based Systems

GPS Data
+ Power Output

Cradle

Mounting Arms

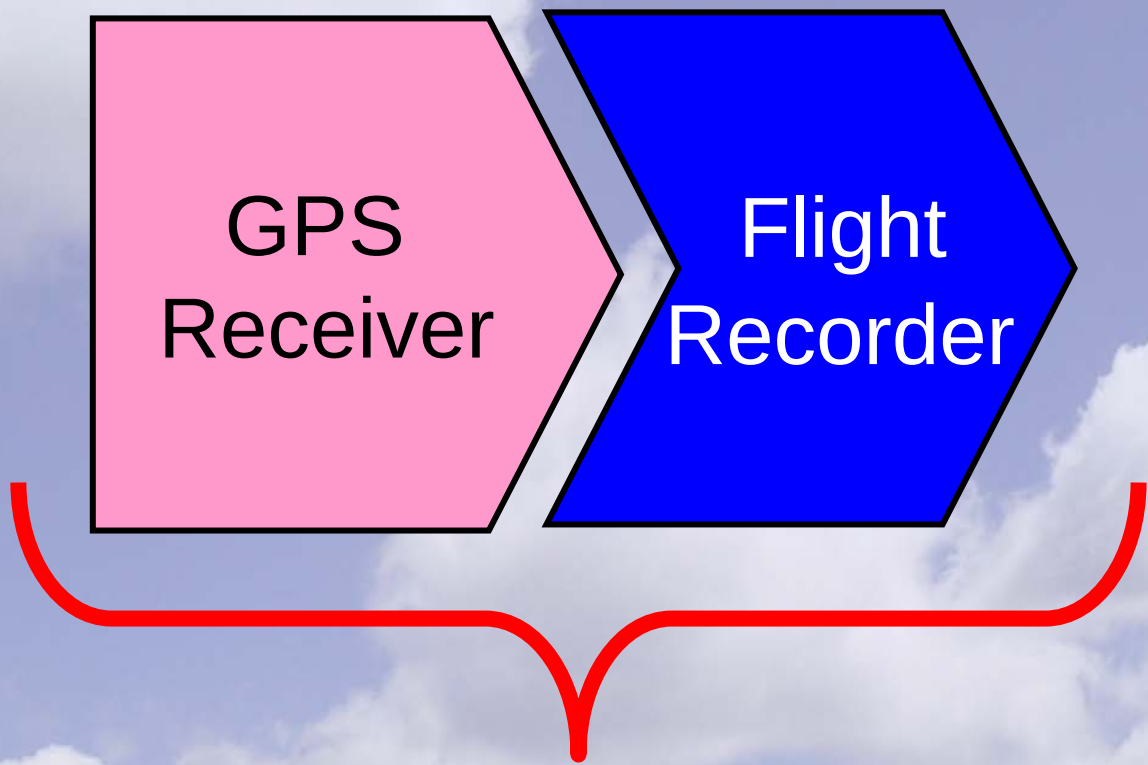
PDA Based Systems

Mounting Arms

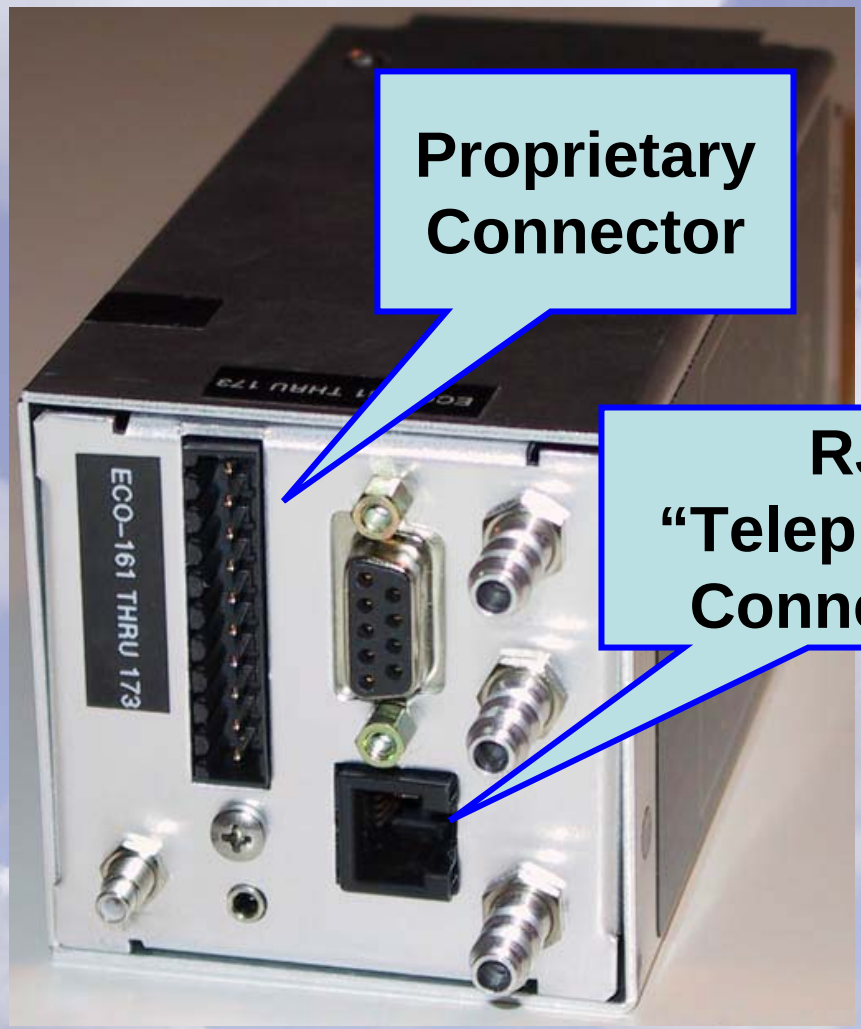
Pilot Info
Glider Info
Turn Point Info
Task Info
GPS Data - Log Files
Power Output

Cradle

The Basic Steps



Power System's Connectors



Power Input to Device

RJ-45 **RJ-11**

Power Requirements

- Most Devices use 12Vdc
  GPS, Recorders, Computers, Avionics, etc
- ***BUT … PDA's require 5vdc!***
- What to do?

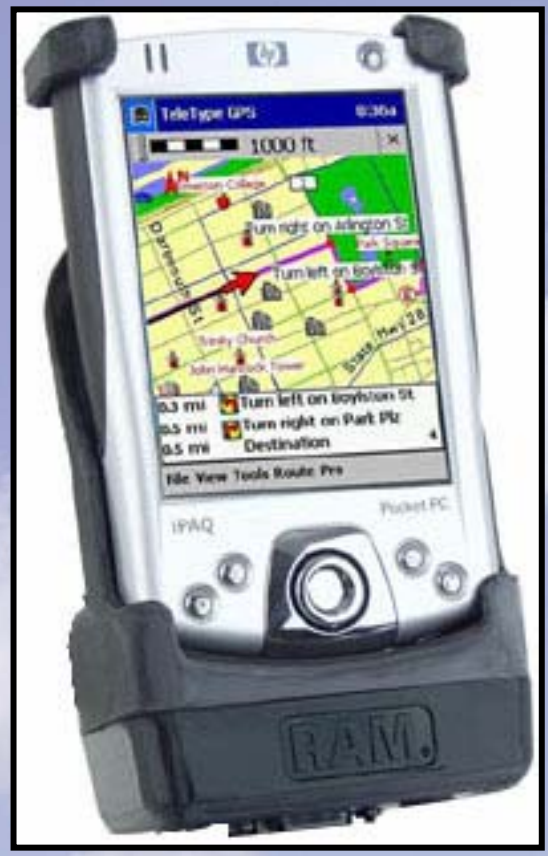
Power Systems

Display

12Vdc Ship's Battery

Some Devices Can Supply 5vdc

Personal Digital Assistant (PDA)
Moving Map Display



Provides 5Vdc

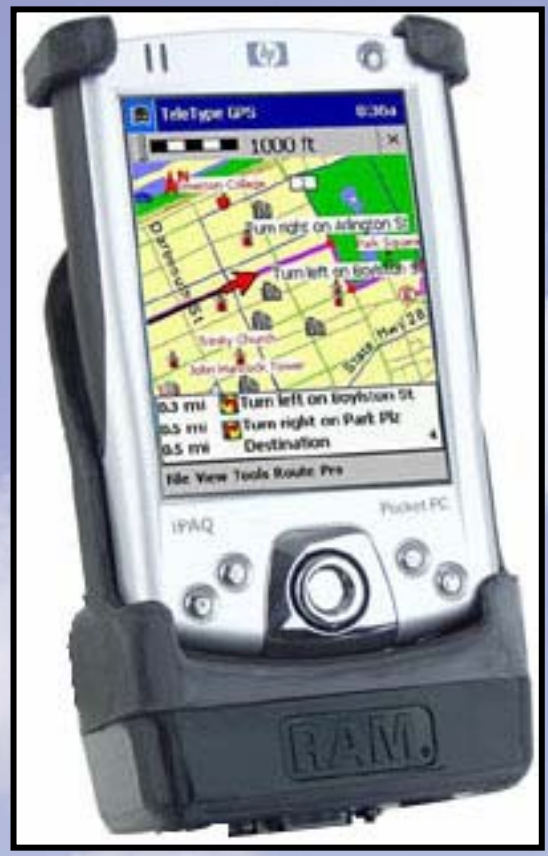
12Vdc Ship's Battery

Some Devices Can Supply 5vdc

Personal Digital Assistant (PDA)
Moving Map Display

Provides 5Vdc

12Vdc Ship's Battery



PDA Based Power Systems

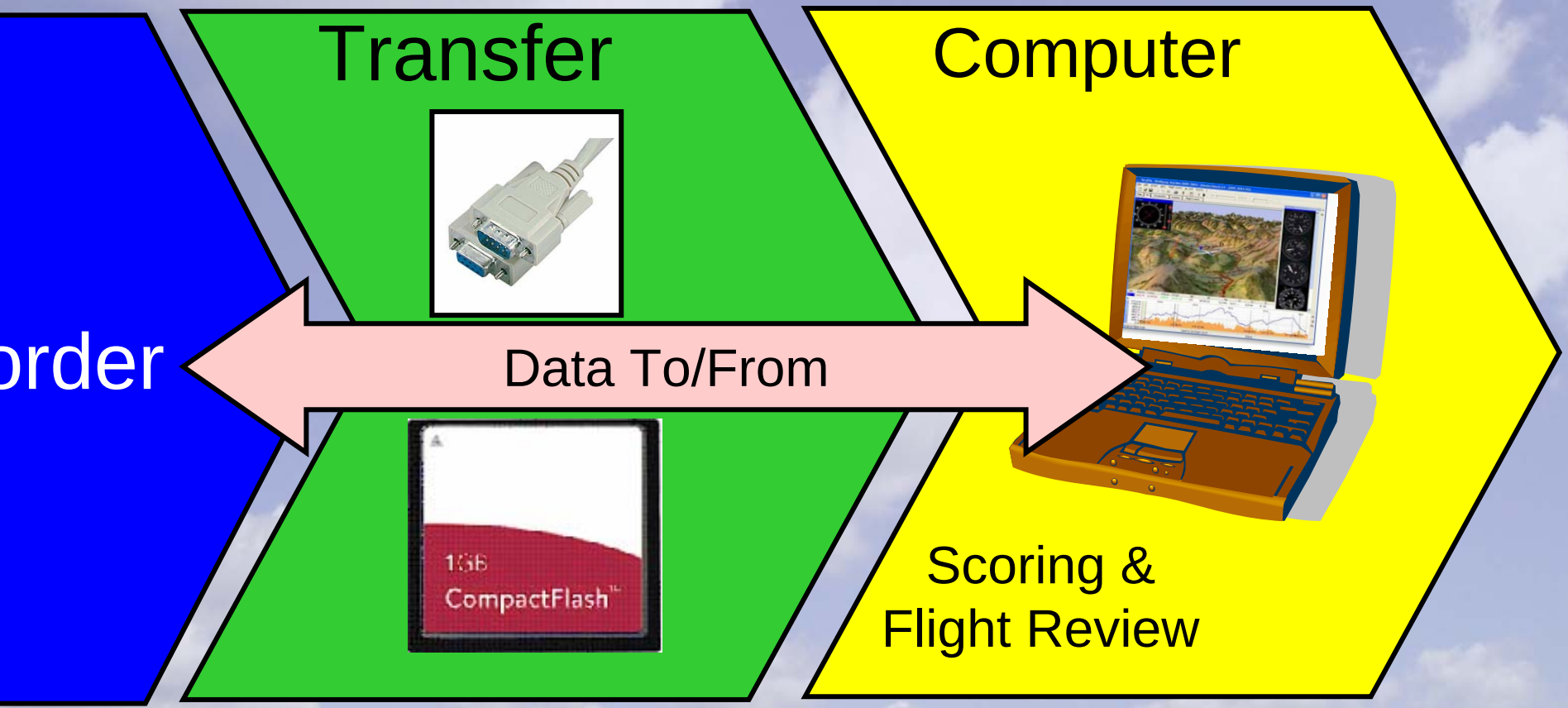
Power Converter

5vdc

12vdc

12Vdc
Ship's
Battery

Steps Before & After the Flight



What Kind of Data?

Turnpoints → **Recorder**

SUA → **Recorder**

Pilot/Glider Info → **Recorder**

Tasks → **Recorder**

Recorder → IGC Flight Logs

for review, scorer/badges

What Kind of Files/Data?

1) Soaring Application (i.e. Stre-Pla, Win Pilot, etc)
2) Turnpoint Database (from turnpoint exchange web site) – Lat/Long of airports, runway, frequency, etc.

Turnpoint File Example

```
** ************* Starting Control Points *********************
2,41:46:19N,088:28:32W,712F,TA,Aurora        ,09/27   20.6
3,42:02:14N,089:23:34W,929F,TA,Barnett       ,09/27   22.9
    52   ,088:58:03W,817F  A,_Be  oit         ,  /25    22
    :3    ,088:39:11W,951   A,_Bi   Foot         /27    22.
          ,088:54              ,Blo  gtnNrm              .6
7,41:45             06              ,Bre   on                .0
8,42:35:30N,089:22                           ,03/21   22.
9,41:31:00N,088:16:00W,580F,TA,E              N/S       18
10,42:32:00N,088:09:30W,755F,TA,Camp Lake   ,18/36    22.9
11,42:08:55N,088:33:35W,860F,TA,CasaDeAerPrk,09/27    30A
12,41:25:55N,                                           20T
13,41:49:52N,                                          22.8
14,41:31:10N,088:36:20W,640F,TA,CushingField,18/36    22.7
15,42:24:15N,088:38:00W,913F,TA,_Dacy         ,09/27   22.9
```

Turnpoint Number

Lat/Long

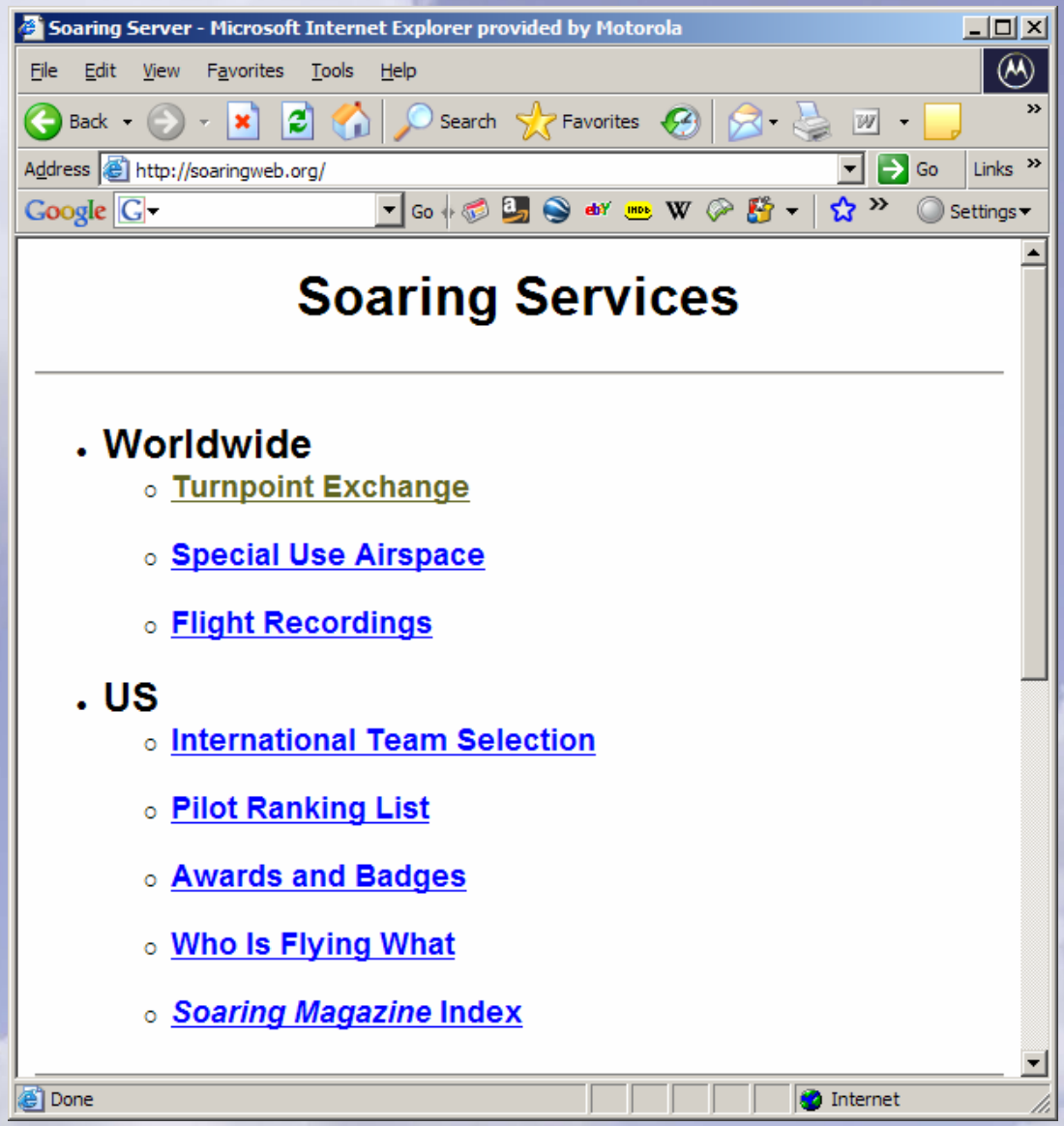
TA Designates this is a "Turn Area"

Turnpoint Name

Runway (if any)

Frequency (i.e. 120.6 Mhz)

http://soaringweb.org



http://soaringweb.org/TP

What Kind of Files/Data?

1) Soaring Application (i.e. Stre-Pla, Win Pilot, etc)
2) Turnpoint Database (from turnpoint exchange web site) – Lat/Long of airports, runway, frequency, etc.
3) Special Use Airspace Database (SUA)
4) Pilot & Glider Config
5) Tasks Config

How to Transfer?

- Computer to/from PDA using included synchronization software
- Generally via simple “Drag & Drop”
- Read the PDA Manual!

Flight Log Retrieval

- How to get the flight log from the flight recorder to your computer or to Scorer?

1. ***Hand entire flight recorder to the scorer***
2. ***Cable flight recorder directly to your computer & use removable media***
3. ***Transfer log file to PDA, synchronize to PC & use removable media***
4. ***Transfer to PDA & then use removable media***

Transfer of Data

Problem: How to do without removing from instrument panel?

Specialized Software
Specific to Recorder

Transfer of Data Remove from Glider

Recharging & Configuration

Log Files

USB Cable

Windows Computer
Mounts as “Hard Drive”

Transfer of Data

Specialized Software
Specific to PDA

Log Files

Serial Cable

Pilot & Glider Info
Turnpoint Info
Task Info
Special Use Airspace

Log Files

Info

Soaring Software

Transfer of Data

Transfer of Data to Floppy or CD

Read Log File with Standard Software

Floppy or CD

Hand to Scorer

Mail to SSA Badge Official

Transfer of Data

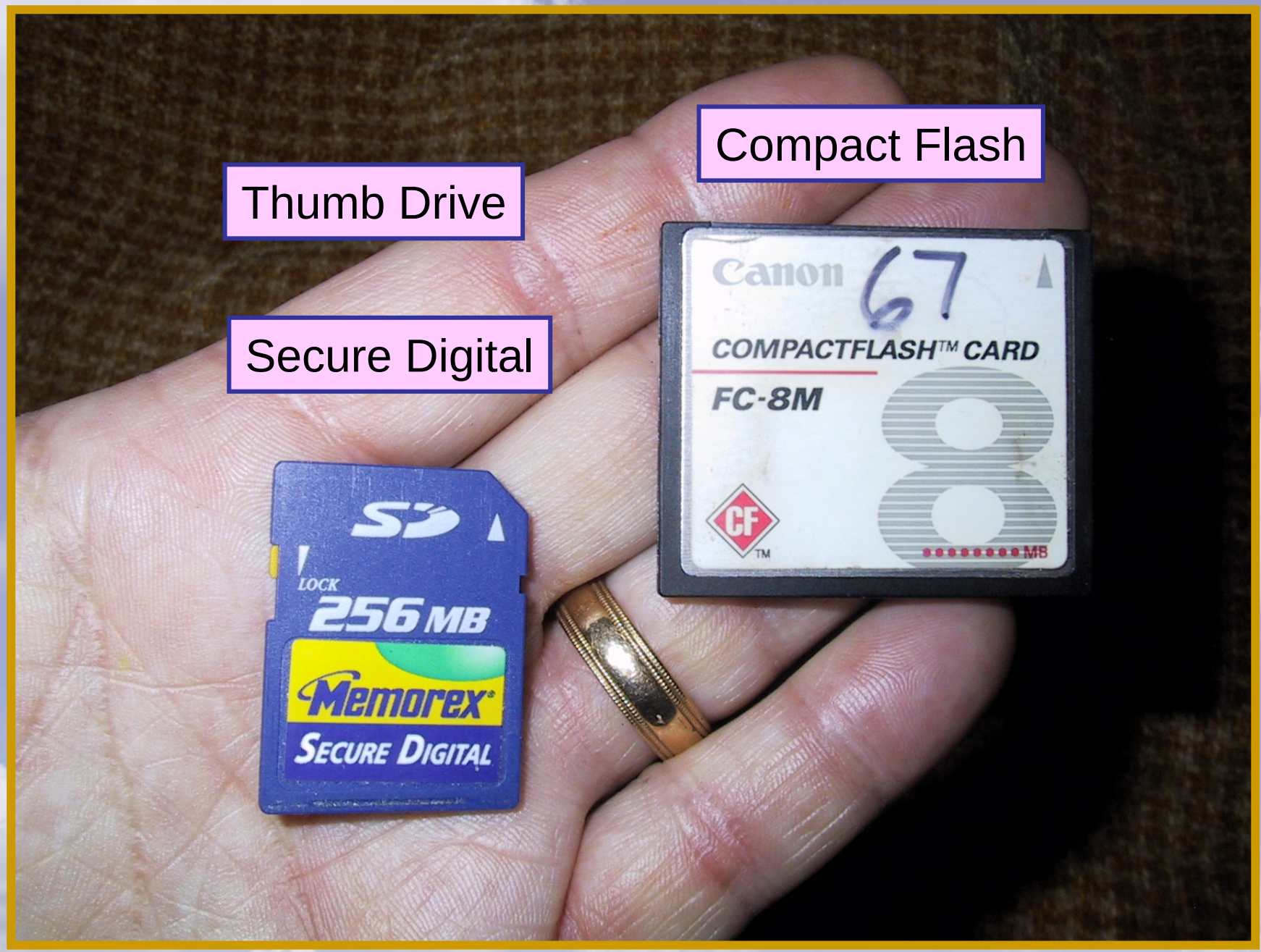
Log Files

Serial Cable

Pilot & Glider Info
Turnpoint Info
Task Info
Special Use Airspace

Soaring Software

Transfer of Data



Transfer of Data to Memory Card

SF – Compact Flash

Transfer Log File

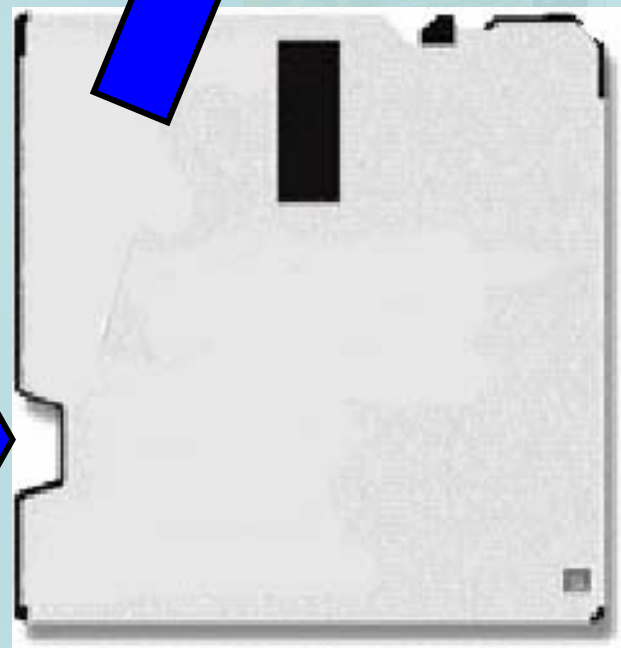
SD – Secure Digital

Read Log File with Standard Software

Hand Card to Scorer
Mail to SSA Badge Official

PCMCIA
"PC" Slot
Removable Media Reader

Floppy Disk Removable Media Reader



USB Removable Media Reader

SD or CF – Which to Use?

- Secure Digital (SD)
  - Prone to spontaneous ejection from PDA

- Compact Flash (CF)
  - More robust
  - Less expensive
  - More physically secure

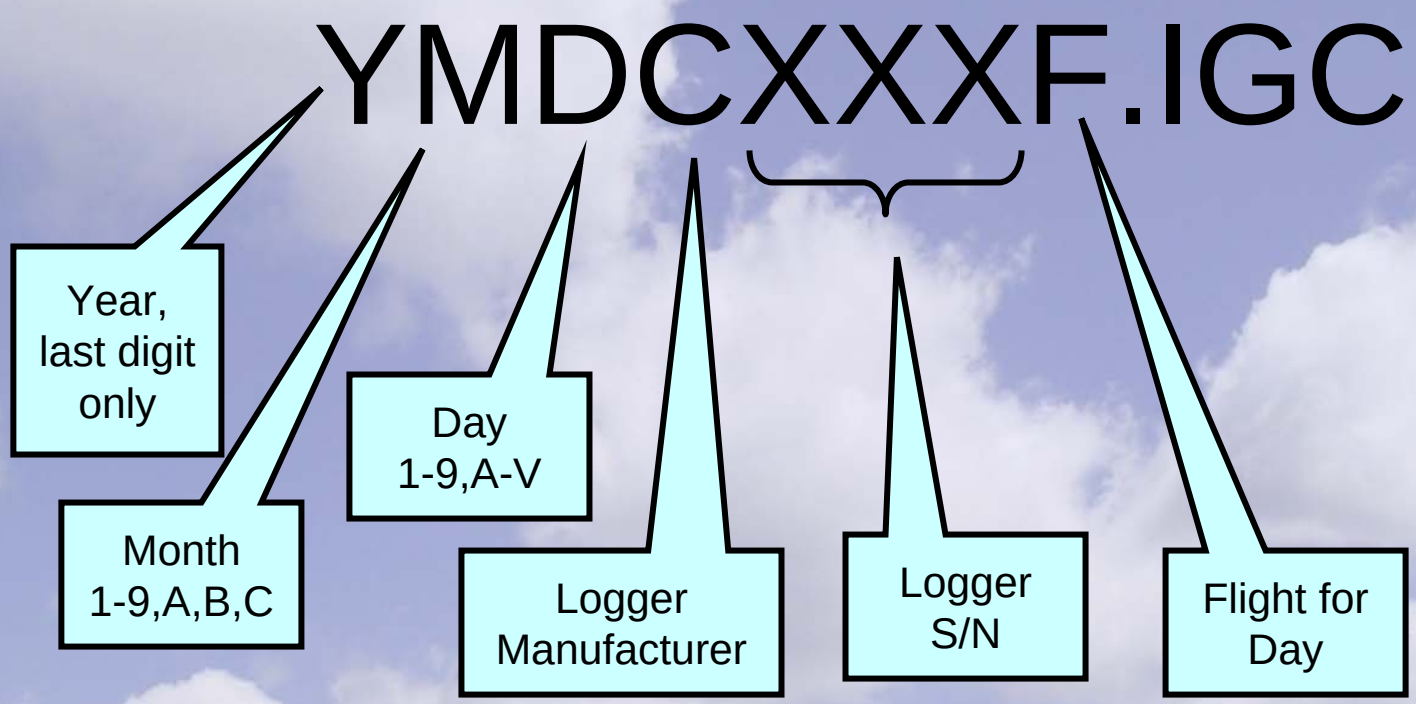
Recommended

IGC File Naming

5AGC3WK1.IGC

Clear as Mud

IGC File Naming



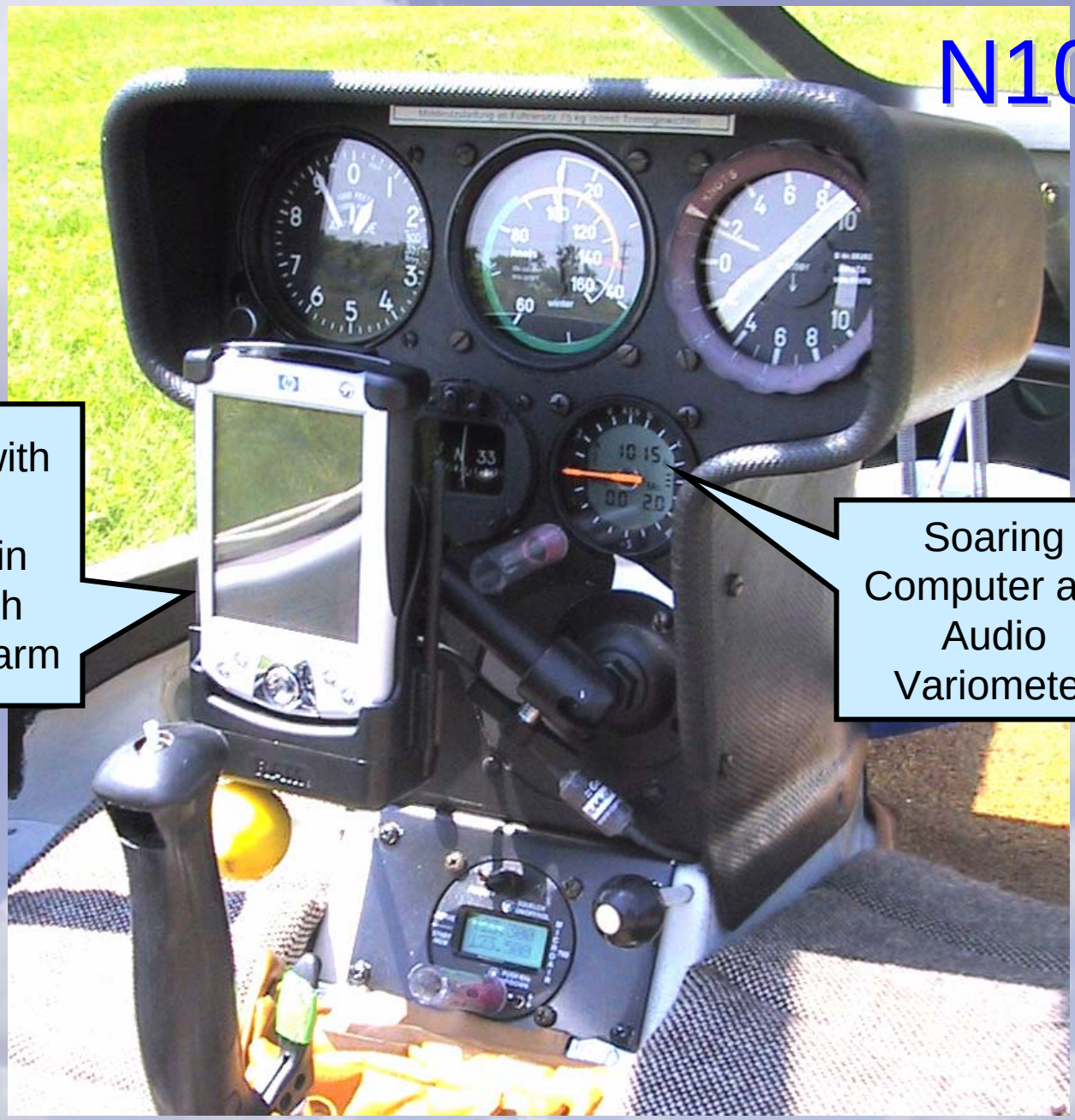
Numbering Breakdown
==========
Month of year
---
1 = January
2 = February
3 = March
4 = April
5 = May
6 = June
7 = July
8 = August
9 = September
A = October
B = November
C = December

Manufacturer of Data logger
==========
A = Garrecht
C = Cambridge
E = EW Avionics
F = Filser
L = LX Navigation
S = Streamline data instruments
W = Westerboer
X = All other manufacturers

Day of Month
==========
1 = 1
2 = 2
3 = 3
4 = 4
5 = 5
6 = 6
7 = 7
8 = 8
9 = 9
A = 10
B = 11
C = 12
D = 13
E = 14
F = 15
G = 16
H = 17
I = 18
J = 19
K = 20
L = 21
M = 22
N = 23

Full technical specs for the IGC files can be found at:
http://www.fai.org/gliding/gnss/tech_spec_gnss.pdf

N101RP



HP IPAQ with Soaring Software in cradle with articulated arm

Soaring Computer and Audio Variometer

The End

Questions?

Reminder: Next Hour's Session on Avionics Wiring

ChicagoLand Glider Council
2007 Spring Seminar
Saturday, Feb 24, 2007

Speakers

Dean Carswell
John Cochrane
Curt Lewis
John Good
Derek Piggott
Karl Striedieck

Registration Forms Available at Front of Room
See http://chicagolandglidercouncil.com for details