Should I switch from using the C-POD to the F-POD?

In any of the following situations you should, if possible, change from the C-POD to the F-POD.

Projects:

- with a long future.
- or expanding substantially in size.
- or has problems arising from these limitations of C-PODs: badly affected by noise; too many false positives; unresolved species discrimination issues; data loss from incorrect starting or corrupted SD cards (e.g. inexperienced operators).

In these situations you should probably stay with the C-POD:

- replacing missing instruments near the end of a project.

How to change:

- Make paired deployments of C-PODs and F-PODs in a range of sites, covering the range of noise regimes and cetacean presence that you have been encountering.
- Get a 'scaling factor' for the difference between the level of your operational statistic for each deployment.
- Do enough replicates of these pairs to see that you have a sufficiently precise estimation of the scaling factor to meet the aim of your project.
- Share your findings with Chelonia and the POD community.

What is the difference between the C-POD to the F-POD?

Here's a comparison:

Feature	***C***	***F***	***Notes***
Future availability	?	good	The existing C-POD uses some components that are near the end of their production life ('EOL') and at some point it will be much more expensive or impossible to produce. At that point there is likely to be a used C-POD market for some years.
SD cards	×	✓	The F can use any blank **32GB microSD card**. The C uses 4GB or 8GB that have to be specially formatted on a native XP machine. They are easily corrupted and this causes problems that are absent from the F, so less data loss occurs. Their size limit results in loss of data at times.
Files stored	×	✓	The F stores **normal files**. The C has permanent 'shell' files and normally overwrites existing data within them. Problems occur when the shell files are corrupted, as when the card fills, and when old data is incorrectly read.

Threshold control	×	✓	The F has a more effective **noise adaptation** through which the threshold is raised in noisy conditions. This means that the card memory will not run out even in long deployments.
Click data stored			*The F stores more information, in 2, 3, 4, 5, 6 below, that gives added power to the train coherence assessment that underpins cetacean detection. This gives better sensitivity at lower false positive rates and reduces the need for visual validation of data.*
1	✓	✓	Click **time** (5 microsecond resolution), click **duration** in cycles, click **max sound pressure** level.
2	✓	✓	Click **bandwidth**: Both deliver an assessment, but this is usefully more accurate in the F. It can be used in real time to control data volumes and is valuable during post-processing.
3	×	✓	**Peak position** within the click; **wavelengths** of cycle before click and four cycles around the peak to 250 ns resolution. This can detect the **downsweep within NBHF clicks**.
4	✓	✓	The C stores an **envelope measure**, but it is not referenced to the loudest cycle. The F stores an **amplitude profile** of 3 peaks around the peak, which is more useful as a click discriminator.
5	×	✓	Number of **amplitude reversals** within the click. This helps distinguish boat sonars from NBHF species.
6	×	✓	**Final wavelength.** The wavelength of the next-to-last cycle in the click. Very useful for species discrimination.
7	×	✓	The **range of wavelengths** with the click.
Amplitude range	×	✓	The F has an **estimation of the amplitude of clipped (loud) clicks** by high resolution measurement of the click amplitude slope between zero and clipping.
Click selection	✓	✓	This is essential to keep data volumes low so that long running times and fast analysis are possible. The F has an improved algorithm. Much **shorter clicks are stored** if they are louder. This increases data volumes but improves dolphin detection.
	×	✓	The F shows better detection of the **phase shift** that often occurs at the transition from an NBHF click to its closely-following replicate, giving more accurate measurement of the real click duration.
Click dropout	✓	×	The C had an intractable problem of **missed clicks**. Often a click was 'dropped' but a multipath replicate following it was stored. The F does not have this problem, giving better data and increased train detection performance.
Sampling rate	✓	✓	The F uses a **1 MHz sampling rate** with upsampling to 4 MHz to give 250 ns resolution. The C uses zero-crossing timing to 200 ns resolution and a peak-hold circuit with on-demand analogue to digital conversion.

Full waveforms	×	✓	In the F a real-time train detection process can identify a small subset of clicks on which **waveform data**, comprising all their cycle wavelengths (to 250 ns resolution) and amplitudes, is stored. This is potentially useful for species discrimination.
Boat sonar detection	×	✓	The F can run, and log, **two frequency-seeking detectors** that find boat sonars and exclude most of their clicks for the rest of that minute. This reduces memory filling by boat sonars, improves boat detection and cetacean train detection. It restarts each minute and does not operate within NBHF click frequency ranges to avoid impairing detection of such species.
200kHz detection		✓	The F can detect **200 kHz sonars** providing useful information on the presence of the boat.
Hydrophone Z plane	×	✓	The F has an **improved hydrophone** with a wider Z-plane range of near-uniformity. This reduces the effect of a POD leaning in a current.
Accelerometer	✓	✓✓✓	The F has a **higher precision 3-axis accelerometer**. This may be useful in tracking behaviour of towed arrays.
Real Time Clock	×	✓	The C has a timer but no clock. The F has a real time clock that gives more accurate timing. So F-POD files have the **correct time** without the user entering the start time as in the C.
Deep Sleep	×	✓	**Logging for much longer than 1 year** is possible with the much lower power consumption in minutes OFF when intermittent logging, e.g. 1 minute in 5, is used.
Partial Sleep	×	✓	In the F this makes a **small reduction in power use** when conditions are quiet relative to the current threshold.
Lithium batteries	×	✓	Lithium primary cells could run an F for **1 year continuously.**
Running time	✓✓	✓✓	Both instruments run for more than 4 months on good alkaline cells. The exact comparison is not yet known. Due to variation in the power consumption of FPGA and PIC microcontrollers (of the same type) there is some variation between instruments.
User feedback	×	✓	The F is **easier to start reliably for new users.**
Faster, more powerful data analysis	✓	✓✓✓	Data analysis by the dedicated freeware (FPOD.exe) is already hugely faster than the analysis of WAV file data from other loggers and false positive rates are much lower. The algorithm has been completely rebuilt for the F to embody lessons learned from the C. It now runs at least twice as fast and delivers better results.
Shared software	✓	✓	FPOD.exe can simultaneously display data from up to 6 PODs of either type.
WAV file conversion		✓	A utility to convert WAV files to virtual F-POD files now exists. It requires a high sampling rate WAV file (>500 kHz). It is partially developed and not optimised, but it can show you where there are things of interest in your files.

Chelonia also plans to develop these additional products: Integral Acoustic Release; Provision for synchronised arrays, and Streamed Data.