ANNEX 7a – F1 Supporting Material for Item f) – F1C 3.3.2

F1C Model Aircrafts reach during the vertical climb a top speed up to 160 km/h. If there is a malfunction and the model shoots down vertically out of control with the engine running, the top speed increases up to 200 km/h or even higher.

As a result of speed and the minimum mass of 750g this bullet can hit the ground or a person with a kinetic energy

*E = 0,5 x m x v² = 0.5 x 0.75 kg x 55,55² m²/s² = 1.157 Joule*

For example, climbing helmets can take 150 Joule from above and 100 Joule from the side. 150 Joule <=> 10 kg stone hitting the helmet with 5,5 m/s = 19,8 km/h!

Or with other words, the energy of a F1C vertical coming down is 8 times higher than a climbing helmet can withstand.

A 10kg stone with 1.157 Joule is coming with 15,2 m/s = 55 km/h <=> falling from a height of almost 12 m!

The running engine, which easily can reach 34.000 rpm in that situation, is not even included in our examination of the danger.

F1C Model Aircrafts out of control have a high potential to cause serious damage on objects and persons!

In the past the whole Freeflight Community was really lucky that no serious accident with person involved has happened, although an unacceptable number of crashes, as a result of a deactivated RDT take place.

***CLARIFICATION OF AN EXISTING RULE [NO CHANGE OF RULE]***

To avoid this in the future “*3.3.2 Characteristics of Model Aircraft with Piston Motor(s) F1C* “*F1C models must be fitted with functional radio control only for irreversible actions to control dethermalisation of the model. This must include stopping the motor if it is still running*.” has to be clarified by adding “*The full functionality of radio control must be available from the moment the model aircraft is ready to be refueled and must be available till the activation of DT by the timer or by radio control.*”

This clarification has to be done ASAP to increase safety, because the handling of F1C Model Aircraft creates situations that allow to start the Model Aircraft without an activated timer and without an activated RDT.

***REASON FOR MISTAKE***

* Model Aircraft is launched without pushing the starter button => timer is not running (affects all timers)
* Starter button has a malfunction during engine run => timer is not running (affects all timers)
* Model Aircraft is launched to early => although the starter button was pushed (e.g. a too short time) the timer did not start (affects only one type of timers – but which is widely in use)

In den following it will be shown, that only in models with timers which to not fulfil the above defined rule change, these scenarios might result in dangerous situations.

***SOLUTION FOR MAXIMUM SAFETY***

From the moment the timer is activated and turns the disc into start position the Model Aircraft can be refueled, the engine can be started and the model can be launched.

This can be done without starting the flight program. It is independent from the energy situation of the timer (sleep-mode or running-mode).

If the RDT is activated from that moment on, the Model Aircraft can be stopped via RDT every time and the risk is reduced to a minimum.

***RISKY SITUATIONS TO BE HANDLED VIA RDT***

* Model Aircraft comes down with running engine at high speed
* Model Aircraft is out of control because the timer was not started or has a malfunction (engine run > 4s)
* Problem before launch with running engine (e.g.: vibration, wing opens, …)

In all this situation the model can be stopped via RDT because the RDT-system is active from the moment you can refuel the Model Aircraft.

***DT VIA RDT***

When RDT-signal is sent to the mode to stop the Model Aircraft the procedure works as followed:

* 1st lever released: Engine stop 0,0 s
* 2nd lever released: Bunt 0,2 s
* 3rd lever released: Wing, Rudder 0,4 s
* 4th lever released: DT 0,6 s

This is only an example. Some Model Aircraft provide more levers for separate function control. The number of lever and functions is not important. The important fact is, that in within 0,6 s (depending on servo speed) after pushing the RDT-button the engine is stopped and the Model Aircraft is dethermilized (DT).

If this happens during high vertical down speed the kinetic energy is reduced to minimum and the risk of creating serious damage is also reduced to a minimum.

***CHANGE IN HANDLING OF MODEL AIRCRAFT***

There is precisely no change in the handling procedure of the Model Aircraft. RDT is working in the background and has no influence until the RDT-button of the RDT-transmitter is pushed.

By comparing the 5 videos in the addendum this becomes fully clear.

***POWER CONSUMPTION***

From the data sheet of the old TORLEIF/BACHMANN receiver it is well known that the power consumption produced by this device is < 1μA in stand by modus. Power consumption increases up to 12 mA during the time the RDT-transmitter is sending data and the RDT-receiver is receiving data.

The system is only consuming energy when it is used for stopping the Model Aircraft. When the RDT-receiver is active in the background after the disc is in start position the consumption is <1μA, that is close to nothing. The battery capacity has not to be changed.

If the modeler wants to change, he can use 300 mAh instead of 150 mAh. That means to invest 6 € and increase the Model Aircraft weight by maximum 8 g (~1% of model weight)!

***FIVE VIDEOS TO VISUALIZE THE PROBLEM***

As the FAI-Webpage does not allow an upload of files with the size of the videos here a like to the cloud which contains all the five videos. Or just click to the headers to open the videos in the cloud or to download the videos.

<https://magentacloud.de/s/mTXgKqriFneCHjn>

[*100 - PROCESSING-F1C - ACTUAL-SYSTEM*](https://magentacloud.de/s/62aqiyTeP8ioMNP) *- no RDT required but available.mp4*

* A normal process with a SIDUS-timer is shown

[*200 - PROCESSING-F1C - ACTUAL-SYSTEM*](https://magentacloud.de/s/zrYi6SgXoFsKkTT) *- RDT required and available.mp4*

* A normal process with a SIDUS-timer is shown, but the RDT is required because of an abnormal flight situation (e.g.: bad launch, fuel tank damaged, …)

[*300 - PROCESSING-F1C - ACTUAL-SYSTEM*](https://magentacloud.de/s/nn43F9G3oE8ytBK) *- RDT required but not available (!)*

* Typical handling mistake with SIDUS-timer is shown, RDT is required (e.g.: flight program not started, bad launch, fuel tank damaged, …) but not active; most of the crashes happen like this

**In “400” and “500” the process is shown with a software update according to the above mentioned proposal installed**.

[*400 - PROCESSING-F1C - SAFE-SYSTEM*](https://magentacloud.de/s/Q9BWsnb723jsbJP) *- RDT required and available.mp4*

* Typical handling mistake with SIDUS-timer is shown, RDT is required (e.g.: bad launch, fuel tank damaged, …) and active

[*500 - PROCESSING-F1C - SAFE-SYSTEM*](https://magentacloud.de/s/7yrPTkNNr6z7Q9o) *- EARLY – RDT.mp4*

* RDT is required before launch, before the timer is activated (e.g.: vibration); at the moment with SIDUS-timer not possible