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*Magnetic Fields*

MEMORIAL ←  
INVITATIONAL 2024

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# Preamble

The summer is here, in full effect. Everyone is seeking cover in the shadows, far from the scorching sun, chugging gallons of cold water, and freezing their brains with big ol' scoops of ice cream. All this heat is too much to bear for the delicate, frail human body... an *average* human body, at least.

There is, however, one peculiar little subset of mankind. One that is anything but average. One that does not fear the heat. One that *craves* the heat. Be it in the frosty woods of Wales or on the sunkissed roads of the Isle of Man, these individuals strive to remain red-hot at all times by incinerating high-octane gasoline with their ferocious motors and dashing among the infernal flames of competition...

...and nothing brings competition as fiery as the Hottest Event of the Summer. This hell is their heaven. This is the seventh annual...

## Magnetic Fields Memorial Invitational

...or *MFMI'24*, for short.

Now, this year has not been an easy one. Coming off the epic, but exhausting, 2023 edition, the next installment was yet again thrown into question. As is usually the case, the community entered a deep coma in the off-season.

The one exception was the — traditional, at this point — interim B-level contest, which this year turned out to be the *Tag Team Turmoil*. It provided some significant takeaways relating to the field ahead of *MFMI*. It saw the debuts of newcomers Noni and InfamousGhost07, who proved to be more than bottom feeders, besting the likes of Lewsys and SBinnala on numerous occasions. Perhaps the biggest revelation of that contest was SForman135LS, who was arguably in the best form of his young career thus far, scoring plenty of stage victories. The same could be said for the two arch adversaries and steadfast favourites — the reigning *MFMI* Champion, Tribell, and former titleholder, Ephemeral. Last year, the former made history by being the first-ever person to win the *Magnetic Fields Memorial Invitational* twice, doing so back-to-back no less. Will he continue breaking records by securing a third consecutive victory? Will Ephemeral finally join the two-time club after four years? Could SForman135LS perhaps shock the system and achieve his maiden triumph in the event? And lest we forget the seasoned veterans or the zealous upstarts! No matter who it is, though, one thing is for sure. We are about to bring hellfire and burn the place down like we always do!

Thank you for taking your time to read this booklet and engaging in the event, be it as a competitor or as a spectator. Make sure to peruse the rest of this paper and we shall meet at the starting line.

*Rally on!*

— Ephemeral

# Overview

*Magnetic Fields Memorial Invitational 2024* is the seventh edition of the yearly community competition, where avid *Mobil 1 Rally Championship* enthusiasts gather to race against each other in the game over the prestigious MFMI Championship, but also to celebrate the legacy of the title and simply have fun.

The contest is essentially an A8 Championship playthrough, where each contestant progresses through the game mode individually, but in synchronisation with the rest of the field, as outlined in the **Schedule** chapter of the booklet.

After each completed leg of the championship, the participants are obliged to submit their corresponding results before the end of the current race day, as specified in the **Result submission and verification** chapter of the booklet. Shortly following the deadline of a given day, the full leg results will be released to the public.

Every rally concludes with each competitor being assigned a number of points based on their performance in the rally, in accordance with the principles explained in the **Scoring system** chapter of the booklet. At the end of the contest, all players will have their points garnered throughout added together, and the one with the highest cumulative score will be declared the MFMI Champion (for the resolution of potential ties, refer to the aforementioned chapter).

Naturally, certain restrictions apply, as detailed in the **Rules** chapter of the booklet. They must be respected by all participants — otherwise, adequate consequences will be exercised.

# Schedule

Table 1 presents the *Magnetic Fields Memorial Invitational 2024* contest schedule. As always, there is a unique set of stages (*leg*) assigned to each day of the contest, meaning that, on a given day, the corresponding stage(s) must be completed in order to advance. The rightmost column provides the in-game service area times available before the respective legs.

Table 1. *Magnetic Fields Memorial Invitational 2024* contest schedule

Date	Day	Leg	Service area
<b>Daunhall Rally of Wales</b>			
Aug 14	1	Clocaenog Mid & Penmachno South	40:00
Aug 15	2	Myherin & Hafren	15:00
Aug 16	3	Dyfi & Gartheliniog	25:00
<b>Pirelli International Rally</b>			
Aug 17	4	Chirdonhead	40:00
Aug 18	5	Falstone	15:00
Aug 19	6	Kershope	13:00
Aug 20	7	Pundershaw	16:00
Aug 21	8	Riccarton & Newcastleton	24:00
<b>Scottish Rally RSAC</b>			
Aug 22	9	Twigglees, Yair & Cardrona	40:00
Aug 23	10	Black Loch & Glentrool	11:00
Aug 24	11	Ae	15:00
<b>SEAT Jim Clark Memorial Rally</b>			
Aug 25	12	Moon and Star, Bothwell & Whitchester	40:00
Aug 26	13	Eccles, Langton & Fogo	11:00
<b>Stena Line Ulster Rally</b>			
Aug 27	14	Hamilton's Folly & Tyrone's Ditches	40:00
Aug 28	15	Feeaney & Parkanaur	14:00
Aug 29	16	Lisnamuck & Tardree	15:00
<b>SONY Manx International Rally</b>			
Aug 30	17	Port Soderick, Ballagyr & Curraghs	40:00
Aug 31	18	Tholt-y-Will, Injerbreck & Cringle	16:00

Each leg begins at 20:00 CEST and lasts precisely 24 hours. For instance, Day 1 (consisting of Clocaenog Mid & Penmachno South) begins on August 14 at 20:00 CEST and ends on August 15 at 20:00 CEST as Day 2 begins.

It is imperative that all participants complete a given leg according to the schedule, as doing so before or after its designated time window is disallowed and might yield significant repercussions, such as disqualification from the rally or the entirety of the contest. At the same time, it is understood that random real-life events may hinder one's progress. In such situations, as long as the interruption is proven to be of urgent nature, the affected contestant has the right to inform the officials about it, who in turn will attempt to collaborate on an agreement in the form of moving the disrupted leg(s) to a different day (or days). The surrogate day(s) must fall under the contest schedule, however, effectively meaning that the requester will be obligated to complete the overdue leg(s) and the current leg, all on the same day. Moreover, even if such an arrangement is established between the two parties, it still has to be approved by the majority of the remaining participants in order to be authorised.

# Result submission and verification

Every run done as part of the event must be documented in video form. The following are viable options (only one is mandatory):

- **Saving and sending the in-game replay file** (found in the `/savedata/replay` subdirectory of the main game directory, named `replayXX`, where `XX` is the numeric identifier under which the replay was saved within the game).
- **Recording the run off-line and sending the footage.**
- **Live-streaming the run and sending the archived VOD.**

If the player decides to record or stream the run, they must ensure the in-game timer is visible for the whole duration of the run.

To speed up the process of verifying results and adding them to the leaderboards, all participants are encouraged to additionally provide pictures containing the achieved stage and rally times — both partial and complete — which are displayed in the menu after completing a stage (the former can also simply be a frame from the game after crossing the finish line, in which case the in-game timer as well as the **STAGE COMPLETE** text must both be visible).

Pictures of the service area screen from the start of the leg are accepted too, but they are not obligatory.

## Exceptions

It is highly advised to document runs in as many ways as possible, so that any form of proof remains in case one or more fail. It is perfectly understandable that some may lack the hardware required to record or stream comfortably, while the in-game replays tend to cause trouble. To retain the integrity of the event, an undocumented run may therefore still be approved on the following conditions:

- a) Proof of the achieved stage times is delivered as described above.
- b) The majority of the rest of the field are in favour of this decision.
- c) A similar situation has not already occurred for the same player.

## Submission methods

Just like in the previous edition, the intended way to submit results is via the form available on the official content website<sup>1</sup> upon clicking the **Submit results** button. In due time, every participant will be given a secret password they will be required to enter with every submission so as to prevent submitting results under the guise of someone else. As already mentioned in the **Overview** chapter of the booklet, full

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<sup>1</sup> Link: [https://redchilli385.github.io/RC2K\\_JanuaryContest\\_2020/html/mFM124/index.html](https://redchilli385.github.io/RC2K_JanuaryContest_2020/html/mFM124/index.html).

results of the current leg must be submitted before the race day ends. For instance, on the first day of the contest, all competitors must complete the first leg of the championship, consisting of the special stages Clocaenog Mid and Penmachno South, then submit the achieved results, along with corresponding proof material, all before August 15 20:00 CEST. Once the contest advances to the next race day at 20:00 CEST, the submission form will automatically update to accept only results for the next leg, simultaneously precluding further result submission for the previous leg.

Please keep in mind that this method is not immune to failure or various impediments (server errors, faulty internet connection on the client side, bugs in the system, and so on), therefore in case such issues arise, the results may be delivered directly to the officials, ideally via a private Discord message. It is requested that no results be shared publicly before they are officially revealed by the officials, as some may prefer not to learn about them until the race day ends.

# Scoring system

Points are awarded after each rally and their value is determined by the rank of the participant in the *rally summary* leaderboard. One point is awarded for ranking last and for each rank higher this value increases by 1. The one exception to this is retirement from the rally, in which case no points are assigned (other players receive the same amount of points as they normally would).

In the event of a tie — i.e. two or more drivers achieving the exact same time, down to the centisecond — all parties involved are assigned the same rank, which is one rank lower than the one of the participant directly ahead in the leaderboard. All participants ranked lower are unaffected and assigned the same ranks as they normally would.

One example of a leaderboard which showcases all of the aforementioned aspects of the scoring system logic is presented in **table 2**.

**Table 2.** Exemplary leaderboard, showcasing the basic principles of the scoring system

Rank	Driver	Time	Points
1	X	50:00.00	5
2	Y	50:10.00	4
2	Z	50:10.00	4
4	A	50:15.00	2
5	B	DNF	0

Points garnered throughout the contest are added together in the final contest rankings, to which the same scoring rules apply. Total rally times are also summed up in accordance with the scoring system and put in a separate leaderboard, but only as an extra. In other words, the final contest rank depends on the total number of points amassed by the player as opposed to the total championship time.

## Weaker Car Bonus

The *Weaker Car Bonus* returns once again, having undergone yet another tweak since last year. The general concept remains the same — each total rally time will be multiplied by the appropriate factor, based on the driver's car, as specified in **table 3**. It is these adjusted times that the rankings will be predicated on. What has changed since the previous edition are the *very* values of the multipliers. Instead of being naively ordered — based loosely on limited data and personal experiences — and incremented by 0.01 for every „superior” car, they have now been determined via sophisticated data mining techniques. The exact process of finding these values is delineated in *Appendix A*. Please note that this feature is continually worked on and it is highly experimental. Additional refinements may therefore be applied even before this year's edition begins. Stay alerted and choose your car wisely!

**Table 3. Weaker Car Bonus multipliers depending on the driven car**

<b>Car</b>	<b>Multiplier</b>
Peugeot 206 WRC	1.12
Mitsubishi Lancer Evo V	1.08
Subaru Impreza WRC	1.10
Mitsubishi Lancer Evo VI	1.06
Seat Córdoba WRC	1.04
Proton Wira/Persona	1.00

It hereby becomes apparent that selecting one of the more suitable vehicles may not necessarily yield better results. For better understanding, **table 4** shows an example of the Weaker Car Bonus in use.

**Table 4. Exemplary leaderboard, showcasing the effects of the Weaker Car Bonus**

<b>Driver Car</b>	<b>Total rally time</b>	<b>WCB Multiplier</b>	<b>Total rally time (WCB-adjusted)</b>
X Proton Wira/Persona	51:40.00	1.00	51:40.00
Y Subaru Impreza WRC	50:00.00	1.10	55:00.00
Z Peugeot 206 WRC	49:20.00	1.12	55:15.20

The accumulated total rally time (the sum of all total rally times) will not be adjusted for this bonus, but it will be composed of the adjusted total rally times.

# Rules

All drivers must obey the following rules and restrictions:

- **Patch 6 must be installed<sup>2</sup>.**
- **No cheat codes**, except for unlocking the A8 Championship — to do so, enter the phrase *WORLD CLASS* as the Player 4 name in the main menu.
- **No game modifications**, except for the following:
  - purely cosmetic changes (textures, car skins, driver names);
  - custom sound effects;
  - quality-of-life modifications, such as widescreen fixes, frame limiters and optimisation enhancements;
  - the *nofmu* and *sensiblesaving* options of the *ral.cfg* file — to enable them, create a folder named *var* in the main game directory (if one does not exist yet), then create a new file named *ral.cfg* inside of the *var* folder (if the file does not exist either), in which write *nofmu=1* and/or *sensiblesaving=1* (depending on which of the two is/are desired — if both, then they must be split into separate lines) and save the file.
- **No game exploits**, such as resetting the car in a way that respawns it in a place further in the stage (*warp cuts*) or going out of bounds.
- **None of the shortcuts presented in figures 1–6 are allowed.**
- **All hay bale chicanes must be driven through, not around** (figures 7 and 8).

All participants are fully held accountable for their actions. Ensuring that the game is in a state that does not violate the imposed rules is therefore absolutely essential; not doing so does not excuse the potential delinquent in any way. Caution and focus while playing is equally important, as employing any of the illegal techniques will not be pardoned, even if done instinctively, out of habit.

Above all, good manners and respect toward fellow players, as well as the officials, is *imperative*. Unsportsmanlike behaviour will not be tolerated and may yield grave consequences, extending beyond the event.

The severity and the exact nature of the punishment for breaking any of the rules may vary from case to case, but by default it amounts to an instant disqualification from the entire event. Objections to a verdict may naturally be raised by anyone deeming it unjust, in which case the officials will attempt to negotiate an alternative penalty with the defendant and the rest of the community.

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<sup>2</sup> The patch can be found at: [https://explosiveracing.net/rc/extr\\_patches.html](https://explosiveracing.net/rc/extr_patches.html). Select the *Official RC2000 Patch 6 (Ver.5.30.0)* option from the list and click the download button.



Figure 1. Banned shortcut #1: Clocaenog Mid — road blocked by a fallen tree at the first square right turn (second sector of the stage)



Figure 2. Banned shortcut #2: Clocaenog Mid — patch of grass populated with trees at the mud-covered hairpin right (third-to-last sector of the stage)



Figure 3. Banned shortcut #3: Gartheinlog — square left turn into a closed road (second sector of the stage)



Figure 4. Banned shortcut #4: Chirdonhead — square right turn into a closed road cutting through the northeastern segment (sixth sector of the stage)



Figure 5. Banned shortcut #5: Chirdonhead — closed road cutting through the loop in the southeastern segment (fourth-to-last sector of the stage)



Figure 6. Banned shortcut #6: Injerbreck — grassy passage cutting through the hairpin right (fifth sector of the stage)



Figure 7. Hay bale chicanes must be driven through



Figure 8. Hay bale chicanes must not be driven around

## Restart policy

Restarting a stage or a leg purely with the aim of achieving a better result is strictly forbidden and ends in an immediate disqualification from the entire competition. This includes — but is not limited to — cases, where:

- The player committed a driving error.
- The player broke one of the rules, which must be documented and admitted, as otherwise the repercussions will be considerably more dire once the officials discover the offense.
- The player performed a false start.
- The player's car behaved in an unexpected way — e.g. shifted into reverse gear while braking.
- The player's car suffered a failure of one of its parts or any other malfunction, for example a lost gear, tyre puncture, and so on.

In such instances, the player ought to simply continue the leg. If the car breaks down completely on the track or fails the service area inspection, the driver must retire from the current rally and resume from the next one as soon as it aligns with the contest schedule. For example, if the player fails the inspection between Feeney and Parkanaur (day 15 of the event), they must retire from the rally (*Stena Line Ulster Rally*) and wait until day 17 of the event to resume from the *SONY Manx International Rally* alongside the rest of the field. Naturally, if the inspection fail or car breakdown occurs during the final rally, the retirement effectively terminates the player's participation in the event.

A situation that warrants another attempt at a stage or a leg is a game crash. It has to be properly documented, however. There are two ways to do so:

- Taking a picture of the error message box with the current time fully visible anywhere in the frame (e.g. the taskbar clock) and sending it to the officials.
- Sending the log file (*logfile.txt*) found in the *var* subfolder of the main game directory to the officials.

The proof must be delivered as soon as possible, but the player may proceed without waiting for the response from the officials.

Restarts are also permitted without any limitations provided that the player has not moved their car since resuming the championship on a given day, which also includes false starts. For instance, if the player has opened the game, loaded the save file, proceeded through the service area, and started the level, then a restart is allowed so long as the countdown has not ended naturally with the **GO!** Command or been interrupted by a false start.

The one requirement is that the leg may only be restarted from the most recent savestate. That is either the start of the current leg or the last driven stage of the current leg if *sensiblesaving* is enabled and the player has saved the game this way.

## **Rule enforcement**

All rules and guidelines established in this document are fully binding throughout the contest. At the same time, they are by no means final and they may be adjusted during the course of the event if need be. However, in order to be sanctioned, any such amendment must be supported by the majority of participants and approved by the officials.

In case of uncertainty regarding the rules, the officials are there to help. Above all, the goal of this event is to provide an enjoyable experience for everyone involved.

# Appendix A

## Weaker Car Bonus calculation methodology

The Weaker Car Bonus multipliers have been determined by applying techniques derived from data mining, statistics and machine learning. The first step involved gathering the necessary data pertaining to the cars, which ultimately provided the following features:

- **Performance:**
  - top speed (in miles per hour);
  - 0–100 km/h acceleration (in seconds).
- **Handling:**
  - steering strength;
  - oversteer intensity;
- **Service area repair times:**
  - fixed:
    - exhaust;
    - turbo;
    - cooling;
    - clutch;
    - differential;
    - gearbox;
    - steering;
    - suspension;
    - brakes;
  - variable:
    - engine;
    - body;
    - electrics;
    - lights.

All features except 0–100 km/h acceleration — which was measured through in-game tests — were read directly from the source code of the game; therefore, they can be considered fully reliable.

The variable repair times are somewhat of a caveat, however, since the growth rate for the same car part *varies* between the different vehicles, for the most part. For instance, consider the engine repair times for the Peugeot 206 WRC and the Seat Córdoba WRC. **Table 5** shows that they are not, in fact, defined by the same function.

The function itself is linear in all cases, as has been deduced by analysing the source code of the game. Moreover, the 1% damage and 100% damage repair times are coded directly into the game, so the fitted lines are an exact match. Naturally, 0% damage yields null repair time and damage grows in increments of 1%.

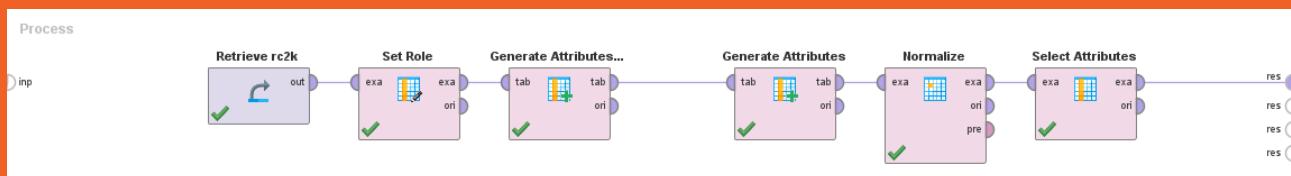
**Table 5.** Comparison of engine repair times between Peugeot 206 WRC and Seat Córdoba WRC

Car	Repair time (in seconds)		Fitted line
	1% damage	100% damage	
Peugeot 206 WRC	20	1080	$f(x) = 10.70x + 9.29$
Seat Córdoba WRC	30	1020	$f(x) = 10x + 20$

Due to the complex nature of the variable repair times, which introduce significant bias to the calculations, they are *omitted* in further steps. They could potentially produce even more reliable multipliers, but that would require delicate numerical transformations, which, in turn, could easily have inverse effects if done improperly.

## Data preprocessing

Next, the collected data was formally organised into a CSU (*comma-separated values*) file and imported into *Altair AI Studio*. It was used to create the workflow shown in **Figure 9**, whose goal is to preprocess the data.



**Figure 9.** Altair AI Studio workflow which preprocesses the car data

The role of each operator is as follows:

- **Retrieve rc2k** — retrieves the CSU file.
- **Set Role** — assigns the *label* role to the *Car* attribute (step relevant only to the process itself).
- **Generate Attributes** — the two operators with this name collectively calculate the „inverted” values for the *Top speed*, *Steering strength* and *Oversteer intensity* features. This is necessary because, unlike the rest, these properties should be *maximised*, rather than *minimised* (i.e. the higher, the better).

„Inverting” the values essentially amounts to reversing their order relative to the cars. It is achieved with a simple formula:

$$\text{InvertedFeature}(i, j) = \min(\text{Feature}(i)) + \max(\text{Feature}(i)) - \text{Feature}(i, j),$$

where  $i$  is the  $i$ -th feature and  $j$  is the  $j$ -th car.

- **Normalize** — normalises the attributes (transforms them into a common scale) using proportional transformation. This is essential to reduce bias and the impact of outliers in the data.
- **Select attributes** — excludes auxiliary attributes from the output dataset.

Figure 10 shows a portion of the resulting dataset containing the preprocessed data.

Row No.	Car	0-100km/h (s)	Exhaust repair time (s)	Turbo repair time (s)	Cooling repair time (s)	Clutch repair time (s)	Differential repair time (s)	Gearbox repair time (s)
1	Mitsubishi Lancer Evo V	0.157	0.163	0.165	0.150	0.177	0.163	0.169
2	Subaru Impreza WRC	0.169	0.154	0.155	0.170	0.181	0.166	0.148
3	Peugeot 206 WRC	0.163	0.154	0.155	0.172	0.073	0.163	0.151
4	Mitsubishi Lancer Evo IV	0.167	0.163	0.165	0.150	0.178	0.163	0.169
5	SEAT Córdoba WRC	0.170	0.173	0.186	0.180	0.189	0.168	0.157
6	Proton Wira/Persona	0.174	0.192	0.175	0.180	0.203	0.177	0.207

Figure 10. A portion of the dataset containing the preprocessed data

## Feature similarity and final multiplier estimation

The preprocessed data was subsequently imported into a spreadsheet, where *feature similarity* was estimated for each car relative to the Proton Wira/Persona, which served as a point of reference, as its multiplier has been ruled to be exactly  $\times 1.00$ . Feature similarity estimation is defined by the following formula:

$$\text{Similarity}(i, j) = \left| 1 - \frac{\text{Feature}(i, j)}{\text{Feature}(i, \text{Proton})} \right| \cdot w_i,$$

where  $i$  is the  $i$ -th feature,  $j$  is the  $j$ -th car and  $w_i$  is the *weight* applied to the  $i$ -th feature. Weights are coefficients which manipulate the impact of a given feature. They are values from the range  $[0, 1]$  and collectively add up to 1. Features *Top Speed (mph)* and *0-100 km/h (s)* were assigned a weight of 0.2; features *Steering strength* and *Oversteer intensity* — 0.1 each — and the remaining 0.6 was distributed over the rest of the features, equaling roughly 0.04 apiece.

The feature similarities were estimated for every feature-car combination, and the multipliers were obtained for each car by summing up the similarities across all features (not averaged out, because of the application of weights) and adding 1.00 (since the multiplier is supposed to *extend* the base time, not replace it). Finally, based on expert knowledge, the computed multipliers were properly adjusted to better reflect the patterns in historical data.

# Disclaimer

Please be aware that everything discussed in this booklet is subject to change. At the same time, some details may have been omitted, either because they are yet to be determined or simply due to human error. The reader is therefore urged to follow the *#contest-discussion* channel in the *RC2H* Discord server<sup>3</sup> to stay updated. Any questions regarding the contest may be freely asked there and the officials will try their best to answer them.

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<sup>3</sup> Link: <https://discord.gg/tpg60wj65q>.