

The page features three large, overlapping blue circles of varying sizes, each with a gradient from dark blue to light blue. Two thin blue lines intersect at the top left, forming a large 'V' shape that frames the text on the left side of the page.

DOGMA

Delay-of-game Management Algorithm

This is the algorithm for monitoring Breakaway ball return. This algorithm simply provides human players with a reasonable amount of time to return the balls to the field based on the number of balls in the queue, while not allowing them the opportunity to manipulate the game. This algorithm is implemented in FMS.

Explanations...

...for the general public (“What’s going on down there?”):

In Breakaway, red robots score into red goals and blue robots score into blue goals. Human players on each Alliance quickly return the balls to the field.

...for the FIRST public (“I care... but only so much”):

In Breakaway, red robots score into red goals and blue robots score into blue goals, earning one point for each ball as it exits the rear of the goal. Human players on each Alliance return each scored ball onto the Ball Return within a pre-determined amount of time (about 10-20 seconds), otherwise they receive a delay-of-game penalty.

...for the FIRST gurus (“I wanna be a HP, what do I gotta know?” or “I want to build my own field, how does FIRST’s field work?”):

In Breakaway, red robots score into red goals and blue robots score into blue goals. As each scored ball travels through the counter at the rear of the goal, the Field Management System (FMS) increment’s that Alliance’s score by 1 point. FMS simultaneously sets an expiration time for that ball based on the match countdown time and following formula:

$$T_{\text{expire}}(x) = T_{\text{score}} - \{ 11 + (4 * \# \text{ other unexpired balls currently in Station}) \}$$

As each ball (x) rolls through the counter at the top of the Ball Return, FMS clears the most imminent expiration time. Any time a ball does not roll through the Ball Return Counter before the countdown timer reaches the next T_{expire} ; FMS assigns that Alliance a delay-of-game penalty.

The sole purpose of DOGMA is to ensure that balls are returned to the field in a timely manner. It is not expected that an Alliance that is paying attention should ever incur any of these penalties.

An example scenario appears on the next page if you care to follow though the gory details.

Example (Red Alliance):

Ball1 is scored in the left goal with 100 seconds remaining on the clock, and there are no other balls currently in the Alliance Station. FMS sets the expiration time for Ball1 at 89 seconds [$ET1 = 100 - (11 + 4 * 0) = 89$].

Four seconds later (at time 96) a second ball (Ball2) is scored in the right goal; Ball1 is still in the Alliance Station, so a second expiration time is set at 81 seconds [$ET2 = 96 - (11 + 4*1) = 81$].

At time 91, Ball1 rolls through the Ball Return Counter, so FMS cancels the Ball1 expiration time (ET1). The sole remaining expiration time is now ET2, set for 81 seconds.

At time 88, a third ball (Ball3) is scored in the left goal; Ball2 is still in the Alliance station, so a third expiration time is set for 73 seconds [$ET3 = 88 - (11 + 4*1) = 73$].

One second later at time 87, a fourth ball (Ball4) is scored in the right goal; Balls 2 and 3 are still in the Alliance Station, so a fourth expiration time is set for 68 seconds [$ET4 = 87 - (11 + 4*2) = 68$].

Unfortunately the human player got distracted, and doesn't get Ball2 through the Ball Return Counter until the 79 second mark. When FMS hit ET2 at 81 seconds, it assigned Red a delay-of-game penalty. ET2 remained active until FMS cleared it when Ball 2 rolled through with 79 seconds remaining.

Fortunately the Human Player wakes up and gets speedy. They next pick up Ball4 and it rolls through at 74 seconds, clearing ET3.

Then they pick up Ball3 (you got it – actual ball order doesn't matter) and it rolls through at 69 seconds, clearing ET4. There are now no balls in the Alliance station, and no remaining expiration times.

During this process (between time mark 100 and time mark 68), Red scored 4 balls and received one delay-of-game penalty.

A graphical version of this example appears on the next page.

