2016 DJI Developer Challenge Official Rules

Introduction:

Since the launch of DJI Developer Platforms, DJI has pushed hard to enable developers to explore the possibilities that drones offer and to create an entire drone ecosystem. The annual DJI Developer Competition extends this further, providing a platform that encourages developers to execute their ideas and make an impact.

In previous years, the Developer Competition has seen developers stretch the boundaries of drone applications and show the massive potential for drones in industry with entries as varied as traffic inspection and wildlife conservation. With so much potential in industrial applications, the 2016 DJI Developer Challenge chose to focus on one solving a problem within one specific industry, pushing technological boundaries while simultaneously creating real world value.

Scenario:

This year, DJI's challenge to developers is to transform search and rescue using drone technology. An important part of search and rescue is the ability to quickly search for and locate survivors. While drone technology is uniquely suited for this, it is often limited by range and requires a skilled pilot for operation. This challenge aims to remove these barriers by fully automating deployment from and returning to a moving vehicle, as well as automatically searching for, locating and streaming back survivor information.

Such a solution could dramatically reduce the time required to locate survivors, as well as increase the safety of rescuers by minimizing the time they need to spend in a disaster zone.

Overview:

The 2016 DJI Developer Challenge is an opportunity for talented students, developers, scientists and technologists to work together with industry-leaders to create the search and rescue solution of the future.

To complete the challenge objective, competitors will need to develop advanced technologies that enable a drone (DJI Matrice 100) to take off and land on a moving vehicle (Ford F150), detect objects and avoid obstacles.

Competitors will be provided with DJI's Matrice 100 (M100) flying platform, X3 (4K gimbal mounted camera), Manifold (portable computation platform) and Guidance (5 directions of depth sensing) as well as DJI's Mobile SDK for iOS and Android, Guidance SDK and Onboard SDK.

The competition has several qualifying rounds. Each round requires teams to submit materials showing how they'll be successful, with the most promising teams progressing to the next round. After the first round, teams will be given hardware to develop on and demonstrate their abilities.

On competition day, teams will be awarded points for successfully identifying and locating objects, landing on a moving Ford F150, and interfacing with the F150's interactive display unit. The team with the most points will win, with ties being decided by shortest mission time.

The winning team will receive US$100,000.

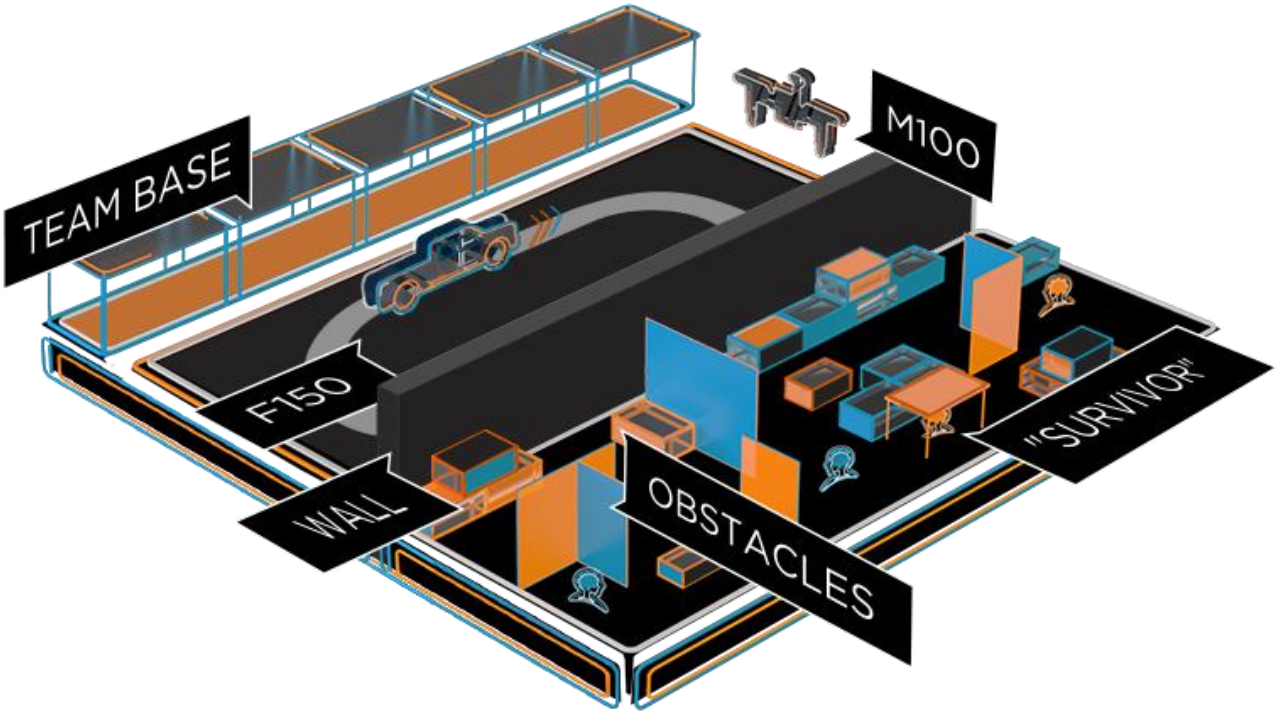
Objective

The M100 must autonomously:

1) Take off from a moving vehicle (Ford F150)
2) Survey a 'Search Area' and gather ID and location information on objects that represent 'Survivors'
3) Feed this information back to an iOS or Android Device in the F150
4) Return to and land on the vehicle.

The Setup

1. The search area will be between 30 x 30m and 50 x 50m. The vehicle will drive in front of the search area on a designated route.



2. Within the Search Area, there will be Survivors, Obstacles, and Debris.
   a. Survivors: There will be a total of 5 survivors, represented by AprilTags in the Search Area.
   b. Obstacles: Obstructions that will interfere with the drone's ability to survey the area. Obstruction height will be above the height needed to detect an AprilTag.
   c. Debris: Mockup furniture, trees, boxes etc.

3. The vehicle (Ford F150) will be equipped with an AprilTag to act as a landing target.

Mission Details

1) Pre-Mission
   a. Teams given GPS coordinates of search area.
   b. Teams given GPS coordinate of Vehicle start location
   c. Teams given approximate GPS coordinates of vehicle path.
   d. Teams given Ground Landing GPS Location

2) Take-off
   a. F150 starts driving
   b. M100 must take off within 1-minute of the F150 reaching its designated speed.
   c. Mission timer starts when the take-off button is pressed.
   d. The F150 will return to and stop at its start point after take-off (and during the search mission).

3) Data Collection & Data Analysis

a. M100 surveys the Search Area and identifies and locates as many Survivors as possible.
b. Survivors are identified by reading the AprilTag.
c. The time each Survivor is found is displayed and recorded.
d. Points awarded for successful identification and location of AprilTags.
e. Points subtracted for false positives.

4) Landing
   a. Cannot land within 2 minutes of taking off.
   b. Teams can choose to land on a moving vehicle, stationary vehicle or on the ground.
      1. Landing on a moving vehicle will yield significantly more points.
      2. Each team can issue one “Start Driving” and one “Stop Driving” command to the F150 driver after mission start.
      3. The “Start Driving” command can only be issued when the M100 is in the ‘Search Area’, and is the only way to initiate a moving vehicle landing.
      4. This allows teams to change landing strategy during the mission
   c. Mission timer stops when the M100 motors switch off.

General Governing Rules

1) Flight must be completely autonomous with no manual joystick commands allowed. Take-off and Landing must be executed with either a UI button in the Mobile app or the interactive display in the F150.

2) The entire mission must be completed with only 1 TB47 battery mounted on the M100.

3) M100 is the mandatory equipment for the mission.

4) Read the Survivor AprilTags, and live stream the footage to the F150.

5) Third-party payloads (sensors, computers) are allowed.

6) Only one competitor (M100 Pilot) is allowed in the F150 and must stay in the F150 throughout the mission.

7) For safety reasons, the mission must be aborted at any time by a judges’ request.
   a. Retries will be granted at the judges’ discretion but should not be relied upon.

8) Start/Stop Driving commands may be issued orally from M100 Pilot to F150 driver.
   a. Once a “Stop Driving” command is issued, the bonus for landing on a moving vehicle is no longer possible

9) The Mobile App:
   a. Must support Chromecast or iOS AirPlay Mirroring for App broadcast
   b. Must display identified objects and locations when detected.

c. Can only support the following mission command buttons:
   i. Start Mission – can only be used to start the mission.
   ii. Abort Landing – can only be used to abort any landing without ending the mission.
   iii. Abort Mission – can only be used to immediately stop the M100's mission and make it hover in place waiting for manual piloting.
d. Abort Mission button is mandatory.

Scoring Criteria

Achievement	**Points**
Successful ID of each Survivor AprilTag	+1
Survivor AprilTag Location (within 5m accuracy)	+1
False Positive Survivor's AprilTag ID	-1
Successfully Landing on Vehicle	+11
Bonus if Vehicle is Moving	+9
Successful Landing on Ground	+3
Use Ford API to initiate mission	+5
• In the event of a tie, the team with the shortest Mission Time wins • Mission ends if landed, aborted or crashed • If landing is unsuccessful, Mission Time is time from take-off to last Survivor AprilTag ID (either true or false positive)	

Logistics:

1st Round Submission (Deadline: March 10, 2016)

1. Team Name
2. Team Member Introduction
   a. Team Leader
   b. Each Member's Bio
3. Technical Proposal
   a. Development Plan
   b. Technical Feasibility Analysis
   c. Development Schedule
   d. Team Members' Responsibilities & Task Assignments
   e. Reference Materials

2nd Round Submission (Deadline: May 3, 2016)

1. Video Demonstration:
   a. Detection and Position of the moving AprilTag (tag will move for at least 30s)
2. Progress Report
   a. Current Status
   b. Implementation Details
   c. Problems Encountered
   d. Revised Development Plan (Please list reference material used)

3rd Round Submission (Deadline: July 11, 2016)

1. Video Demonstration:
   a. M100 landing on AprilTag (moving tag will be judged more favorably)
   b. M100 able to avoid object while searching for an AprilTag
2. Progress Report
   a. Current Status
   b. Implementation Details
   c. Problems Encountered
   d. Revised Development Plan (Please list reference material used)

Equipment and Resources

1. 2nd Qualifying Round:
   a. M100, Manifold, Guidance, X3
   b. Ford API Library and Emulator
   c. Example AprilTags for objects and vehicle
2. 3rd Qualifying Round
   a. Extra Battery

Equipment Replacement Policy

1. DJI development kits and the corresponding accessories will be supplied to the teams depending on the qualifying round.
2. Up to one full set of DJI the development kit (M100 + Manifold + Guidance + X3) will be available to the teams for replacement of parts broken during development. Up to 2 sets of additional replacement propellers and propeller arms will also be available.
3. Additional replacements will be available to teams at discounted prices.

Prize

1) One and only one team will be selected as the winning team based on the Scoring Criteria, and will receive a monetary award in the amount of USD 100,000 (One Hundred Thousand U.S. Dollars).
2) The winning team will be announced on the same day of the Final Competition after all teams have finished trials.
3) Any disputes will be handled as written in the 2016 DJI Developer Competition Terms and Conditions.

Important Notes

Vehicle speed will be defined by the first elimination round, but will be equal to or less than 20 mph (9 m/s). Competition rules may evolve as progress reports from qualifying rounds are assessed.

Version History

Feb 2016:
Version 2.0: Original Public Release