Building an Aircraft Setup Database Together

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So you stepped up and bought that new turbine aircraft (or picked up a smaller helicopter or plane for some specialty work). After taking it out for a spin, you bring it back into the shop and are ready to go to work.

One of the first items of business is setting up your spray boom. You make your nozzle selections based on spray rates, droplet size and the products you will be using in your operation. The next question is where to put them along the spray boom to generate the most uniform pattern possible. If you are saying to yourself, "It sure would nice if there was a set of guidelines for nozzle placement," then keep reading.

The USDA-ARS Aerial Application Technology Research Unit (AATRU) in College Station, Texas, is working to develop just that and seeking your help to do so. Simply stated, we are crowdsourcing this research project. We are working to develop a database containing the following information:

- Aircraft Type (Make and Model)
- Type and Number of Nozzles
- Spray Rate
- Intended Swath Width
- Nozzle Locations that Produce Uniform Patterns
- Pattern Uniformity and Effective Swath (as determined at an Operation S.A.F.E. clinic or by an Operation S.A.F.E. analyst)
- Plus a few other details shown in Fig. 1.

Ultimately, this database will allow operators to see the "demonstrated optimum" nozzle locations that were found to produce the lowest coefficient of variations *(CVs, see sidebar note)* for their aircraft model and operational parameters. After setting up the aircraft, the operator would then go to an Operation S.A.F.E. spray characterization clinic for final adjustments to the nozzle locations. This will potentially reduce the number of passes needed to finalize an aircraft setup at a spray clinic and help avoid pattern issues until a test opportunity become available.

To help populate this database, Dr. Dan Martin, an agricultural engineer with AATRU, has developed a form (Fig. 1) that can be used on an iPad during a spray clinic conducted by an Operation S.A.F.E. certified analyst. There are three rows of nozzle locations shown on the form. The plan is for the aircraft and nozzle configuration to be recorded before the aircraft makes the first set of passes over the string at a spray clinic. After the spray pattern has been analyzed, the S.A.F.E. analyst may decide to adjust some nozzle locations to increase spray uniformity and lower the CV. These adjustments are noted and marked on the second field of nozzle locations. The aircraft would again be

What is CV?

Coefficient of variation (CV) is a statistical term that represents the variation in a data set. The more variable the data, the higher the CV. For aerial applicators, the CV is a measurement of spray uniformity from their aircraft as determined by measuring dye concentration on a cotton string that the aircraft flies over and sprays during an Operation S.A.F.E. spray characterization clinic (see www.agaviation.org/operationsafe for more information on spray clinics). The CV is used to help determine the effective or recommended swath width for the aircraft as it was set up during the clinic.

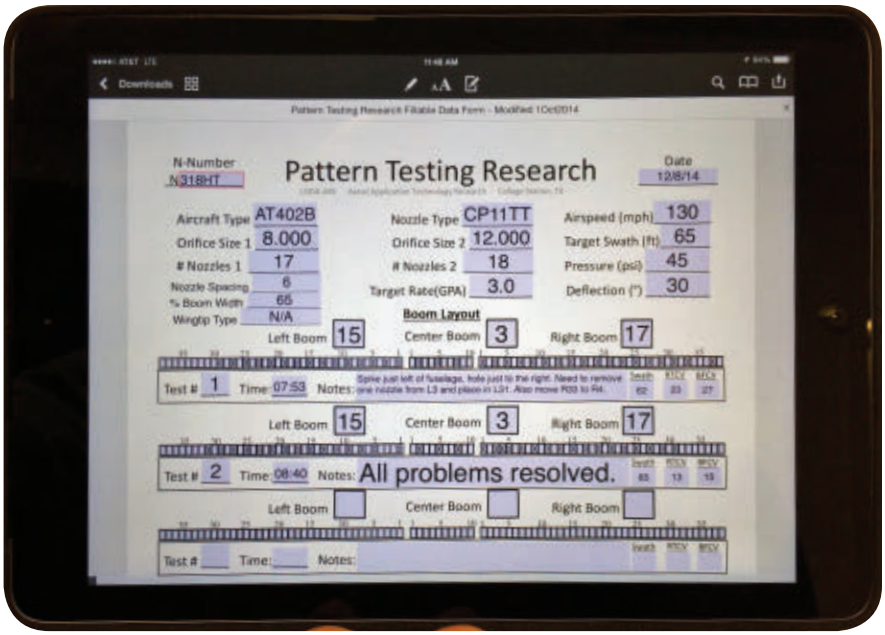

Fig. 1. *Screenshot of Aircraft Setup Fillable PDF on iPad.*

The Aerial Application Technology Research Unit is crowdsourcing its latest research project and needs applicators' help to develop a comprehensive aircraft setup database.

analyzed and the process repeated or stopped depending on the results.

Filling in the information on this form accomplishes two things at once. First, you have a permanent record of how your aircraft was set up at the clinic that you can print out and keep with the aircraft as a reminder if any changes are made. Secondly, you can contribute to the overall database by sending the data to Dr. Martin. ***You have our PROMISE that all times, dates and N numbers will be permanently removed prior to entering your information into the database.***

Now, let's clarify how the database would be used by going through an example from the very limited data we have so far. We currently have nine data sets for an Air Tractor 502B with CP11TT nozzles. Five of these setups had CVs less than 15 percent and four had CVs greater than 15 percent. When we look at the percent of cases that a nozzle was at a given location on the boom, we can begin to "see" what nozzle locations most commonly produce lower CVs. For the right side of the boom (Fig. 2), there is a slight difference in nozzle locations based on the spray uniformity or CV, with nozzles generally placed one position further out on the boom providing a better overall spray pattern uniformity. Again, this is a limited dataset, but once the total observations in the database grows, these trends should be more definitive.

After we get a season's worth of data, we will make the database available to the aerial application community. We sincerely hope that you can help us with this project and look forward to hearing from you. For further information or to request the fillable PDF, please contact Dr. Dan Martin (dan.martin@ars.usda.gov). He will also send you instructions for saving the PDF to generate the database file. ■

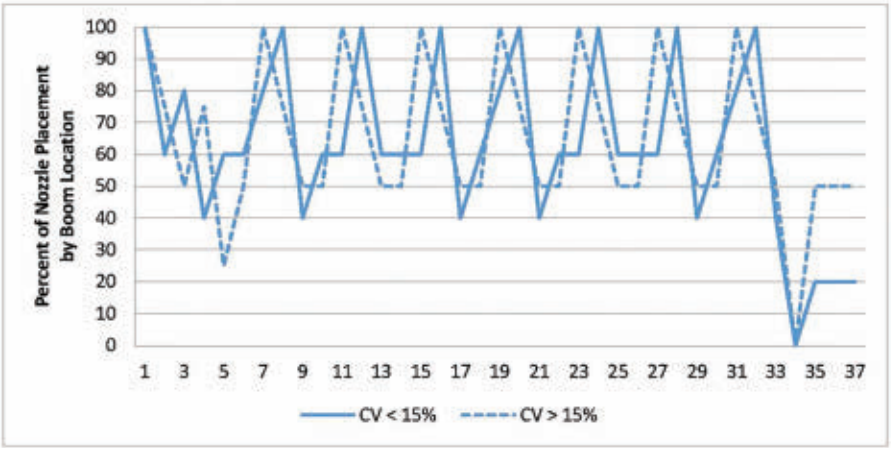

Fig. 2. *Nozzle locations as a percentage of aircraft with Coefficient of Variations (CVs) less than 15 percent and CVs greater than 15 percent.*