RANGE CHECK METHODS & SOLUTIONS YOU AND YOUR TURBINE POWERD JET AIRCRAFT WILL SURVIVE WITH!! 12/29/2005

I. Why do range checks?

- **A requirement of the AMA Safety code! It reads; I will have completed a successful radio equipment ground-range check before the first flight of a new or repaired model aircraft.**
- **After spending weeks or even months to build and or gobs of money to purchase a turbine powered Jet model aircraft…. wouldn't you like to know that your radio's R/F link is strong enough for you to stay in control?**
- **The most important consideration in doing a range check is creating a standard by which you can confidently judge your radios ability to keep you in positive control of your aircraft at all times. One sure method to create a level of consistency (a standard output) is to fully extend the transmitter antenna to do our range checks! The problem with this method is that it requires two people, ½ mile or more of open unobstructed road, runway, or field and some way to communicate that distance. Because of these prerequisites in practice this method is somewhat impractical!**

II. Now a standard Range Check for (any type of R/C radio).

- **I am recommending transmitter antenna be collapsed not removed, equaling one stage or about 7 inches total length of antenna for all radios during range checks. The advantage being one person can do a one-stage range check, and we maintain a level of consistency of transmitter output between all brands of radios.**
- **As you may know some radio manufactures recommend removing the antenna, or fully collapsing the antenna. One stage out creates a standard that we can comfortably check any brand of radio against others and by doing so create a standard for comparison at similar distances. A standard that allows us to recognize when our R/F link is too weak for safe operation of a Jet model aircraft.**
- **Examples: JR 10 channel series fully collapsed but mounted; Futaba 9Z series antenna pulled out of the transmitter body but fully collapsed; Futaba 14MZ mounted but fully collapsed; Futaba 9C pulled out of the transmitter body one stage extended; all create similar output levels with 7 inches of antenna.**
- **NOTE: The limit for R/C transmitter output is 750mW (¾watt). Most transmitters are shipped today providing less than 450mW output. Assuming average transmitter output, other major factors affecting a solid R/F link (measured by range checking) are: on-board electrical device interference; receiver antenna position in relationship to those on-board interference creating devices; and finally just plane old poor receiver quality and or tuning.**
- **Higher than normal (450mW) transmitter output can help improve an otherwise weak R/F link created by on-board interference, poor receiver tuning, and or receiver antenna positioning.**

III. With this preliminary information offered the first thing you want to do is a BASELINE range Check. What is a baseline range check?

- **BASELINE range is distance measured with NO onboard interference devices operating. No electric motors, strobe lights, smoke pump motors, turbine ECU's operating or even plugged in. Only the receiver and servos operating!**
- **BASELINE distances you will be looking for are 200 paces or about 600 feet normal; 150 paces or about 450 feet minimum!**
- **If your Baseline range check is less than 150 paces (450 feet), send the receiver and transmitter module and or complete transmitter back to factory service for tuning & alignment. Let the service center know what you expect to see for a minimum range, with 7 inches of transmitter antenna. Note these distances are predicated upon following standards described in section IV. "Doing the two Phase Range check"**

IV. Doing the Two Phase Range check: Baseline and Engine running or (Powered up)

1. **The first thing to do is make sure all batteries are charged and in top condition. Possibly two-receiver battery packs, ECU, and transmitter included. Two receiver battery packs are fairly standard in Jets or 20 + lb aircraft flying today.**
2. **NOTE: For minimum walking distances (approx. 200 paces) and maintaining standard to include all brands / types of radios; the transmitter antenna should be attached, and collapsed to provide one stage in length or approximately 7 inches.**
3. **Mount your aircraft securely on a strong wood or plastic stand so that your receiver antenna is approximately three feet above the ground. This is an important step to provide consistently accurate range checks. Range checks that won't vary because of ground effect.**
4. **Position your aircraft & more importantly your receiver antenna (perpendicular) not (parallel) to the direction your planning to walk. If your doing the range check by yourself & with no help orient your aircraft so that you will be able to see your Elevator or Rudder move at a distance of 600 feet or more! This can be done with correct positioning in relationship to the reflection of the Sun and the direction your going to walk.**
5. **Set two radio fail-safes: Full elevator or rudder deflection, and idle position for your motor.**
6. **If this is a BASELINE range check the first in our two Phase range check, do not turn anything ON in the aircraft other than your receiver, unplug your ECU, strobe lights, etc.**
7. **With you transmitter antenna mounted but collapsed (equaling 7 inches) turn ON your transmitter and receiver, check to see if your fail-safe setting is working properly by turning OFF the transmitter. Elevator or Rudder should fully deflect. OK**
8. **If this is a "Powered up" everything running range check, turn all on-board equipment on including starting your turbine. Also be prepared to operate your smoke system, strobe lights, etc. Make sure your airplane is mounted securely to a solid stand! Start up & throttle up to about ½ power. Even though a powered up range check can be accomplished by one person, I strongly suggest you have a friend stay near your aircraft fire extinguisher at the ready. Your friend should stay at least 5 feet away from your aircraft during the range check.**
9. **Walk out counting your paces up to 100, if you can't get out at least 100 paces baseline or powered up your in deep do-do! Remember your transmitters antenna is mounted but collapsed to equal 7 inches in length, and your aircraft is mounted firmly on a plastic or wood stand receiver antenna about 3 feet above the ground! After the first 100 paces (approximately 300 feet) continue out stopping every 20 paces. I want you to hold your transmitter exactly the way you will when flying. Yes, that means in the tray, or with neck strap on etc! As you get out to the limit of your R/F link there will be fewer paces between checkpoints. Turn left & right as far as possible keeping your fail-safe surface visible, if baseline. Remember the sun trick if your doing this alone! If this is a powered up test do the same thing but listen for your motor to go to idle. Continue out until you find the limit of distance you can do this without any surface movement BASELINE or surface movement and engine changing power to idle if POWERED UP. Remember powered up means check with all possible on board interference emitting components operating!**
    - **Make note of the maximum distances for BASELINE & POWERED UP. The difference or loss of range between Baseline & Powered up is what we are looking to note! If your Powered up distance is 20% less than Baseline then your work has just begun. Don't fly if the difference is more than 20% make changes and recheck the powered up range until the loss is less than 20%.**
    - **In my opinion "Don't Fly" a turbine powered Jet aircraft if your powered up range is less than 120 paces or 360 feet.**
    - **Remember on completion of your range checks before flying to reset your fail-safes: All turbines to shutdown set for a maximum of a two second delay per AMA.**

V. Methods of correcting a short Powered Up range check:

This is where things get tricky and when the most creative ideas you can come up with might help or may hurt. The problem is you must keep doing range checks one after the other to know when you've discovered and corrected what is causing the reduced range. Don't make more than one correction at a time so you will know what actually improved the range.

1. Reposition the receiver antenna; make sure it is as far as possible from any on-board electrical device. Reposition the receiver to as far away from any on-board electrical device, especially a turbine ECU or fuel pump motor. You may even want to install a whip antenna. Many times this alone will increase your range enough to do the job.
    - There are basically two types of whip antenna's
    - External or internally mounted base loaded shorter in length: these require careful installation and possible factory tuning to your receiver to maintain or increase your original Baseline range, and more importantly increase your powered up range check distance!
    - Long wire externally mounted whip antennas: can provide a greater antenna / aircraft component jux-a-position than the original wire receiver antenna. These whip antenna's won't need any factory receiver re-tuning because they replace the original wire antenna inch for inch. There greatest advantage is how far they allow you to place the antenna from any on-board interference producing electric components.
    - Note: Some scale modelers don't like the long whip antennas because they are quite visible, and don't look anything like what you might see on a full-scale airplane. <u>If the externally mounted short or long wire whip antenna corrects a short powered up range check, forget about looks and use it!</u>
2. If changing the receiver antenna location and or type of antenna doesn't help your range you obviously have some on-board electric component or components that are really killing your range. The process of elimination here may help. If you have other on-board devices such as: smoke pumps, strobe lights turn them off. You did check these during your powered up range check didn't you? Note: I have a friend that got great range checks until he tried his smoke system; his range was almost cut in ½ when the smoke system was tested. Remember if your going to use it in-flight you'd better check it out during your range check(s) while your still sitting safely on the ground.
3. Another technique I have used during the component elimination process was to do an ECU plugged in receiver on No turbine running range check. You will discover some loss in range with just the ECU idling. Yep as a matter of fact some older type ECU's emit as much or more RFI as will the fuel pump motor. Consider this method of elimination to help pinpoint the source of the interference. As a general rule of thumb keep your receiver and receiver antenna as far away from any turbine component as possible!
4. Ring core filters / chokes installed on your ECU battery or fuel pump wiring may help: Ring core chokes installed on other turbine and receiver / turbine wiring are known to have helped. Do a simple search on-line to find out more about the ring core chokes and where to purchase them.

5. Moving components around inside your aircraft to different locations may help. Find out where others have successfully mounted components or your aircraft i.e., manufactures suggested and tested component location. Your receiver, receiver battery, ECU battery, turbine fuel pump location relative to your receiver antenna can make a big difference. Keep in mind only one change at a time or you'll never know for sure what fixed your range check problem.
6. I have found that a weak transmitter module (if your transmitter is configured with a removable R/F module) or just a plain old weak transmitter can be the source of your short-range check distances! In several cases I have improved an otherwise unacceptable powered up range check into the acceptable range by just changing transmitter modules, or having the module repaired. Heat damage and age can lower the output of your transmitter!
    - The truth is the one thing that can help or hurt our R/F link most significantly is the relative power output of our transmitter! In my opinion only second to a total electrical failure!
    - NOTE: R/C radio manufactures today are forced to cut a fine line between keeping transmitter power outputs low (to prevent 3IM amongst so many closely spaced channels) but high enough to give us a solid R/F link. Not an easy task considering the wide variety of application. Example: Turbine powered Jet Model Aircraft!
7. I have also found that changing frequencies (channels) can in some circumstances improve powered up measured distances, transmitter power output differences notwithstanding. Yes some frequencies will work better than others within a given aircraft component configuration!
8. In extreme cases placing EMI / RFI emitting components in specially designed and grounded aluminum boxes, shielding all turbine related wiring, can dramatically help if everything is grounded properly! I have found that shielding / blocking on-board RFI & EMI can be very effective when all interconnected components are shielded and grounded back to their power supplies. Not an easy task, but when done correctly can block 99% of EMI & RFI generated by onboard components. Proper shielding can produce powered up range checks that show less than 10 feet degradation from baseline-measured distances.

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