What about TSO's?

Another question to be answered is what, if any, of the equipment needs to be "TSO'ed". In order to address this question, it's helpful to understand what a "TSO" is. TSO stands for Technical Standard Order, which is defined in 14 CFR Part 21, section 21.601(b)(1) as "….a minimum performance standard for specified articles (for the purpose of this subpart, articles means materials, parts, processes, or appliances) used on civil aircraft." As you can see from this definition, a TSO is actually a performance standard to which an article can be manufactured.

When someone says an article is "TSO'ed", what they really mean is that the unit was manufactured under a TSO authorization. Section 21.601(b)(2) says, "A TSO authorization is an FAA design and production approval issued to the manufacturer of an article which has been found to meet a specific TSO". You'll note that the TSO and TSO authorization deal specifically with design and manufacture, and have nothing to do with installation or operation.

Now we have an idea what a TSO is, but we still haven't answered the question of whether or not our instruments and avionics need to be "TSO'ed". Our Operating Limitations state that we have to equip the aircraft in accordance with 91.205, and 91.205 lists the minimum equipment required, but nowhere is there mention of a requirement for TSO'ed equipment. Thus, the answer is NO,

So far, so good, but that's not the whole story.

Transponders and related equipment;

One item that will be high on the list of desired equipment will be a transponder. It's interesting to note that 91.205 does not list a transponder as required in order to operate under IFR. While this is true, our current airspace system as well as the advantages for use in both IFR and VFR operations makes a transponder a popular when outfitting their aircraft.

The requirements for transponder equipment and operation are found in 91.215, which has this to say:

(a) *All airspace: U.S.-registered civil aircraft.* For operations not conducted under part 121 or 135 of this chapter, ATC transponder equipment installed must meet the performance and environmental requirements of any class of TSO-C74b (Mode A) or any class of TSO-C74c (Mode A with altitude reporting capability) as appropriate, or the appropriate class of TSO-C112 (Mode S).

Note that, while it is required that the transponder equipment meet the performance and environmental requirements of the applicable TSO, it is not required that the equipment be manufactured under a TSO authorization. In theory, this means that you could actually build your own transponder, so long as you can document that it meets the requirements of the applicable TSO. However, the easiest way to be assured that your transponder meets the requirements of 91.215(a) is to install one that has been built under a TSO authorization.

The requirements for altitude reporting equipment associated with the transponder are called out in 91.217(c), which states that, the altimeters and digitizers must meet the standards of TSO-C10b and TSO-C88, respectively. TSO-C10b applies to the sensitive altimeter itself, and TSO-C88 applies to the automatic altitude reporting equipment. Again the equipment is required to meet the standards of the applicable TSO's, but not necessarily be produced under a TSO authorization. But as with the transponder, the easiest way for a builder to meet this requirement is to install equipment manufactured under a TSO authorization.

Remember that, in order to legally operate this equipment under IFR, you must also comply with the maintenance and testing requirements of parts 91.411 (for altimeter and altitude reporting equipment),

and 91.413 (for the transponder). Note that the requirements of 91.413 apply even if the aircraft is operated only under VFR.

The bottom line;

All of this leads us to the conclusion that none of the equipment installed in a aircraft is required to be built under a TSO authorization.