

## Checklists: The Often Overlooked Tool

*“What d’ya think I’m stupid? Checklists are for dummies.”  
“I know what I’m doing. I’ve done it for years. Why would I ever need a checklist?”*

I continue to be amazed at the resistance of maintainers and operators when I suggest the use of checklists for critical tasks. Maybe it’s just me: I make lots of lists and check things off as I go through a “normal” (or abnormal) day on the job. When I was taking pilot training, the use of checklists was drilled into my brain. In my 17 or so years studying NASCAR race teams, I have seen thousands of checklists being used by highly skilled people every day. Are checklists part of your reliability improvement tool box?

First, what are checklists? In many cases they are mnemonic (yes, the “m” is silent) devices that act as a memory aid or a learning aid. First, there are verbal mnemonics that help us remember things. “Roy G. Biv” helps us remember the sequence of colors in a rainbow (red, orange, yellow, green, blue, indigo and violet). Then there’s the poem we use to remember the number of days in each month: “Thirty days has September, April, June and November...” Visual mnemonics include acronyms such as SCUBA (self-contained underwater breathing apparatus) and TPM (Total Productive Maintenance). Spelling lessons in school also used visual mnemonics. The words principal and principle can often be confused, so remembering that the **principal** can be your **pal** helps sort out which word refers to a person and not a basic truth, law or assumption.

The checklist is another form of visual mnemonic because it visually reminds us of what to do or lists a sequence of events. There are several different types of checklists to consider. Here are the two most common for our line of work:

- The laundry list
- The sequential list of events

### **The Laundry List**

The “laundry list” is used to make sure all of the items are gathered and sorted. An order pick list used in warehouse distribution centers is one example. A grocery shopping list is another when picking up the specific items is important.

**Racecar Preparation:** NASCAR race teams use this “laundry list” form of checklist to stock the hauler truck. To finish preparing a racecar to leave the shop for the race track, a large one-page checklist covers all of the major areas of the racecar and lists everything that must be completed in each of the following areas: front suspension, rear suspension, drive train, wiring, interior, brakes, and fuel system. Everything must be checked, prepared, assembled, and signed off for the car to be completed and the checklist to be removed from the racecar.

### **The Sequential Checklist**

The “sequential” checklist not only itemizes all of the important tasks but places them in an order of task performance. While a detailed “procedure” defines how all of the critical tasks are to be performed, the checklist provides an ordered summary of each critical task or step in the procedure. Here are some examples from airplanes to healthcare:

**Pilot’s Checklists:** Aircraft pilots use the sequential type of list every time they prepare to fly and throughout the entire flight operation. But pilots did not always use checklists. Their beginning dates back to 1935 at Wright Field in Dayton, Ohio. Even though their aircraft was favored by the Army, Boeing lost a competitive bid to Douglas Aircraft because of a takeoff crash during its final test labeling the aircraft

“too much airplane for one man to fly.” Despite the highly experienced flight crew, the cause was labeled “pilot error.” So the Boeing pilots got together and developed checklists to ensure everything was done and nothing was overlooked. These checklists included take-off, flight, before landing and after landing. Using these checklists, the pilots and co-pilots then flew more than 9,200 hours and 1.8 million miles without a serious accident. The U.S. Army eventually ordered 12,731 of these B-17 “Flying Fortress” aircraft. Today’s pilots and flight crews use checklists during every phase of flight from pre-flight to powering down after landing.

Many small aircraft pilots also use many verbal/visual mnemonics. For example an emergency landing checklist is summarized as **FIELD**: fuel off, ignition off, electrics off, lap-straps tight, doors open. This outlines a critical sequence of tasks and is not a replacement for pilot training and qualification.

**Medical Checklists:** Mistakes happen in the world of high-tech medicine that can result in serious complications or death. Dr. Peter Provonost, a critical care researcher at Johns Hopkins University, was concerned about the ten-percent hospital-acquired infection rate, which was killing 90,000 patients and costing \$11 billion per year. He concluded that posting a simple five-step checklist reminding physicians of each step in a routine dramatically reduces medical errors and infections. This five-step checklist to reduce infections in an ICU procedure is:

Doctors should:

1. Wash their hands with soap
2. Clean the patient’s skin with chlorhexidine antiseptic
3. Put sterile drapes over the patient
4. Wear a sterile mask, hat, gown, and gloves
5. Put a sterile dressing over the catheter site

**Resistance to checklists:** Early experiences with this five-step “Doctor’s Checklist” showed that there were three reasons why doctors and hospitals “could not implement this checklist procedure.” First, some physicians were insulted. Their egos were hurt. Second, staff believed they were already too busy and that more bureaucratic tasks would get in the way. Third, such “mundane” research was ignored in favor of the more “exciting” issues. But if infections and deaths could be prevented, the resistance to the checklist had to be overcome.

The results? One hundred Michigan hospitals started using Provonost’s checklists in ICU’s in 2003. Within three months, the hospital-acquired infections dropped from 2.7 per 1,000 patients to zero. More than 1,500 lives were saved during the first 18 months. Along with the checklists, physicians were trained in checklist function and use, and supply carts were standardized and controlled for one-time use. A culture change also happened: The doctors and clinicians no longer believe that infections are inevitable but rather they are preventable using very simple procedures. (This University of Michigan study is published in the *British Medical Journal* in February 2010.)

### **Formatting Checklists**

Formats of checklists are also critical to their usefulness. Consider the following five checklist elements borrowed from Western Michigan University’s **Checklist for Formatting Checklists**:

1. **Context:** Title, purpose, how and when to use, tools and supplies needed, where to go for help, dated version of the checklist

2. **Content:** Complete, technically accurate, precise terminology, specific action required, action verbs, no jargon or humor, terms defined, one activity per item, examples provided as needed, no extraneous material, etc.
3. **Structure:** Think sequential order when needed, numbered items, visual breaks (white space) or lines to separate items, important items are highlighted to capture attention (bold, boxed, centered), emphasize the word “not” at each use (**not**, not), text is easy to read in the actual use setting, etc.
4. **Images (if needed):** Images on left side of page, explanation to the right or immediately below, shown from the user’s perspective, used for an obvious purpose, only show essential information, etc.
5. **Usability:** Draft checklists tested, tried by target audience, one user tryout at a time, no help provided during tryout, revisions made based on results, tryouts continued until users were able to use the checklists as intended.

### **Making Your Maintenance and Reliability Checklists**

Checklists are not the starting point for improving equipment performance and reliability. They merely summarize the critical tasks or steps that are covered in detailed procedures and training. They serve as visual cues or reminders of important points learned in training sessions. Errors made by skilled and knowledgeable people, as well as trainees, happen every day in today’s workplace. But they can be avoided. Start your consideration of checklist development by asking this question:

#### **Do the consequences of failure justify the use of checklists to help prevent human error?**

Will errors result in penalizing personal injury, environmental incidents, costly defects or off quality production, equipment damage, overly lengthy or incorrect repairs, lengthy or inaccurate changeovers?

#### **Are the detailed “how to” procedures accurate and complete for the critical tasks?**

If so, checklists should be developed to help assure compliance to the procedure.

**Keep it simple:** Checklists should not be confused with procedures. Complex procedures with detailed descriptions of each task are sometimes required. These can be formatted much like a checklist in a multi-page document or manual. However, most checklists are a single page (OK, some pages are larger than others) containing key tasks only with a check box or a blank for the person’s initials. And remember, checklists are used by experienced and qualified people and are not a substitute for training.

Here are a few examples of checklists that can be used to improve maintenance and reliability:

**Parts Kitting:** A parts kit list for a work order helps improve maintenance efficiency and effectiveness. All of the parts needed for the maintenance job are gathered and put in a secured place before the work is scheduled. There is no sequence or order to this type of list. Just make sure all of the stuff needed to complete the job is gathered in one place and checked off in the process.

**Checklists for accountability and hand-off:** Some checklists serve only as reminders or visual cues of tasks and sequence. The only accountability relates to the checklist being followed as written, for example a startup checklist. In the case of repair and maintenance checklists, it might be important that each item be checked or signed off as it is performed. The initials of the person performing the task allows follow-up to issues or questions. These initials also can be helpful when handing off a lengthy procedure to a follow up crew or maintainer to complete a job already underway.

**Checklists as historical reliability records:** Some maintenance checklists are sequential and have critical measurements that must be made, verified and/or recorded. These checklists should possess the accountability as described above as well as the actual readings or measurements made. In some cases, these checklists should contain certain “Go-No Go” conditions, specification, or criteria.

The bottom line is this: Most reliability problems are caused by people making errors or overlooking proven maintenance and reliability techniques during the machine’s life cycle. Checklists help save lives and help make racecars and aircraft safe and reliable. So why not make checklists a vital part of your M&R toolbox and lead the culture change today?

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