

# Systems Engineering and a New Puppy

Randy Bullard

INCOSE

randall.bullard@wpafb.af.mil

Copyright © 2009 by Randy Bullard. Published and used by INCOSE with permission.

## **Abstract.**

During a break at the 2008 INCOSE International Symposium, a discussion ensued regarding the need for introducing the younger population to the systems engineering processes. My first thought was how to best present SE in a context that my 10-year-old daughter would grasp. The last time she was in my office, we used a dry-erase board to write out “requirements” for her “need” of a new pet. She desperately wanted a new puppy, and together we used the SE process to acquire her new pet. While she may not completely grasp the SE Engine or Vee diagram, she fully appreciated the process that delivered a new puppy to our home.

## **Document**

July 11<sup>th</sup> was a big day: “Twister” arrived at his new home. Little known to him at the time, the process that brought him to our home began many months in advance. This process involved systems engineering (SE), not unlike some of the same processes used to acquire multi-billion dollar systems. The minor difference was that SE was used not by a corporate chief engineer, but by a 10-year-old in search of a new pet.

## **A Promise and a Snow Day.**

My daughter wanted a puppy for Christmas. As cute as that sounds, it just wasn’t the best time to get a new pet. So, instead of a puppy under the tree, she got a promise that we would get a new pet sometime during the summer.

As was typical during winter, Dayton, OH received a lot of snow in January. During one of those days, my daughter’s school was closed; however, I still needed to report to work, and my only feasible solution was to have a “bring your child to work day.” She delighted in this, and wanted to learn what a systems engineer really does. Rather than bore her with policy and regulations, we used a computer and dry-erase board to discuss the SE processes. Needing a context to facilitate this discussion to a 10-year-old, the “acquisition” of her future pet seemed to be the best example.

## **The “Needs” Process.**

My daughter was the “end user,” so it became her “needs” that were to be met. To develop a really good statement of needs, the initial starting point was to visit informative dog sites on the web. She literally researched over a hundred dog breeds, looking at their pluses and minuses. Once she determined that a house pet was what she wanted, we began a discussion about requirements. She started jotting down what she wanted in a dog on the dry-erase board, using a bullet format. Once she had composed several “wants” on the board, it became time to accomplish requirements refinement, and introduce the concept of constraints.

## **Analysis of Alternatives (AoA).**

Further requirements and constraints were added by the owner of the home (me), serving as a joint stakeholder. Additionally, we talked about cost and schedule, and even did an AoA. The budget part of it was limited to \$300, and was based on historical data from the purchase of three previous puppies. The schedule was set as no earlier than July 8<sup>th</sup>, since this marked the return of my daughter from her three-week educational tour. It was proposed by me, and accepted by her, that it would be best to wait and get a dog when we could both be there to welcome it into our home.

The AoA took place as we debated buying a new puppy versus adopting an older puppy from the pound. We weighed the pros and cons, including the cost and schedule. The primary argument for *buying* a new puppy centered on being able to name it. Also considered was that we could train it from the start. Conversely, the main benefit of *adopting* a puppy was the cost factor. In the end, the decision was made (and documented) to purchase a new puppy.

## **Human Systems Integration (HSI).**

Since one of my co-workers specialized in HSI, we decided to fold in considerations from that particular SE specialty. One minor difference was substituting canine for human, giving us a new acronym: CSI. Several factors emerged and required intense scrutiny. First, the issue of climate was considered. It was important to acquire a breed whose coat was suited for the environmental conditions experienced in mid-Ohio (a.k.a. CSI: Dayton). Specifically, based upon past operational experience, it was undesirable to have a dog that balked at outdoor trips in the snow to accomplish “essential elimination matters.” Second, there was the pre-existing condition of a chinchilla. This mix of a rabbit and squirrel (that’s the topic for another paper) is quite skittish, so a breed friendly to other types of pets was a necessity. Third, the size issue was examined from the perspective of operational use, as in walks on a leash. My daughter’s previous dog, a 100-pound Great Pyrenees, had a habit of dragging her handler during walks. An additional derived requirement with respect to the size consideration was traced to environmental considerations, as in the aforementioned elimination matters.

## **Life-Cycle Analysis.**

One of the key tenets of good SE is considering the entire life cycle. It was essential my daughter realized that a puppy doesn’t stay that way forever, but instead grows up to be a dog. Part of her research involved studying and then classifying the characteristics of various adult breeds, including tendencies to bark/howl, maintenance requirements (shedding), and the need for exercise. This also surfaced the rather delicate issue of life expectancy. It was decided (by me) that in this one instance we wouldn’t practice good SE, and that discussions regarding the last phase of the life cycle would be deferred until a more appropriate time.

## **Requirements Analysis.**

All of these requirements, and constraints, were postulated on the dry-erase board. Prioritization was accomplished using multi-colored markers. (Note: When blue is someone’s favorite color, all

requirements listed in that color are a top priority.) The initial final requirements composed on that snowy day, captured from the dry-erase board, are listed in Figure 1.

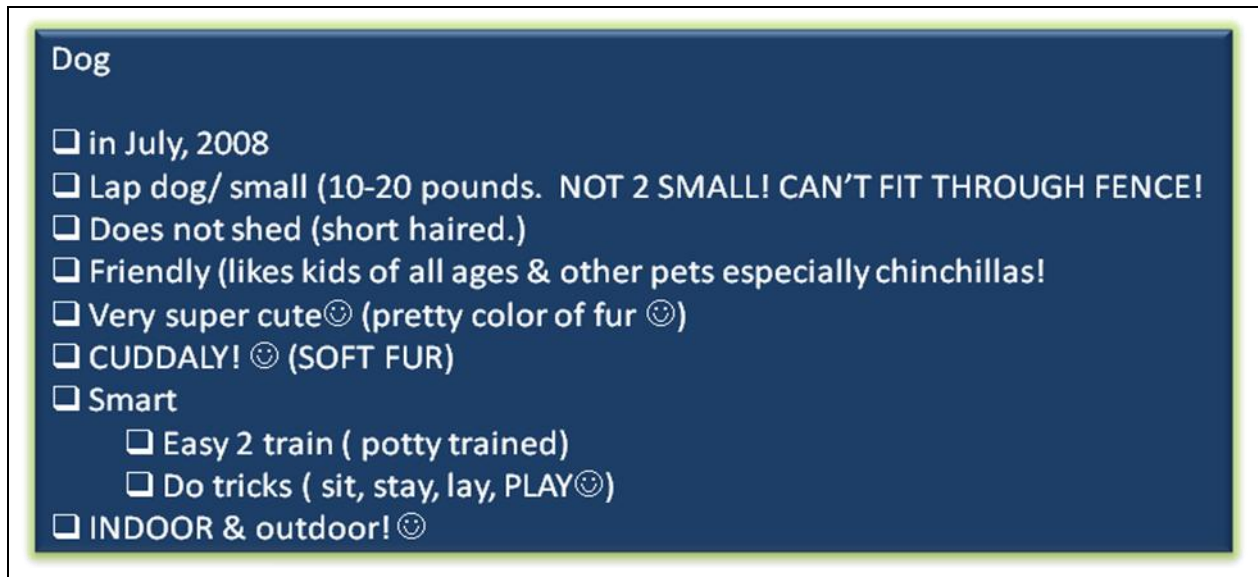


Figure1. Initial final requirements.

### **“Waiting is the hardest thing to do.”**

For 10-year-olds (and the rest of us), waiting six months for anything, even more so a puppy, is terribly difficult. We would periodically re-visit our requirements, and review them to ensure correctness and completeness. One of my daughter’s favorite things to do was to look at one of our dog books, and rank order different breeds of dogs that best met our requirements. Another fun project was to make a list of names, both for males and females.

By April, this exercise had yielded the Beagle and English Springer Spaniel as the top two prospects. To further the SE process, and to help with developing patience, we began to verify supplier availability. This was done by checking the local classifieds and internet advertisements, in order to verify what breeds of dogs were typically available in our general area. Since a precedent had been set with a previous dog of driving two hours to purchase her, we set up a similar “search circle” which included bigger cities such as Columbus, Cincinnati, Louisville, and Indianapolis.

To my dismay, searching on-line caused my daughter to completely lose focus of her requirements. She would see cute Boxer puppy pictures, and immediately want one of them. (For the non-dog aficionados, Boxers are a great breed but definitely exceed our size limitations.) Since dog pound sites were also visited, she had to revisit our previous AoA. After some debate, we decided as joint stakeholders to stick with the initial decision of purchasing a new puppy.

The “name game” became an entire sub-project during the month of May. We made an alphabetical list from A to Z of all plausible puppy names, and grouped them for both dog breed and gender (some were neither breed nor gender specific). Next, we narrowed down the list by

applying a stakeholder veto process to each suggested name. For example, I suggested the name “Regal” for a male Beagle, but my daughter used her veto power to remove it from our list.

### **Source Selection/Test and Evaluation.**

As part of her research, my daughter learned that seven weeks is the earliest one should separate a puppy from its mother. Since it was best to bring home a new puppy when we would have time to devote for a proper acclimation, a weekend delivery of July 11<sup>th</sup> was agreed upon by the two principal stakeholders (her and me). Working backwards from the initial delivery date, puppies born on or before Memorial Day became prime candidates.

We began our search in earnest the first weekend of June. Our well-defined (and oft-practiced) search criteria yielded several results, with one that appeared the most promising (i.e., best meeting our requirements). The top candidate was a new litter of Beagle puppies born to a local breeder that would be available after July 5<sup>th</sup>. We made a call to the breeder requesting an appointment, and set one for later that day.

### **Test and Evaluation.**

After a discussion about the selection process, my daughter decided to invite one of her best friends to accompany us. Her friend would perform the function of an independent authority, assisting in the test and evaluation (T&E) phase. While a best attempt was made to prepare both girls for an objective evaluation process, the realization was that the “cuteness” factor of looking at new puppies would all but make this essential part of the process nonexistent.

A (T&E) plan was hastily developed. (Lesson learned: this plan should have been drafted along with the initial requirements.) This plan would consist of two steps: the first would be to visit the puppies, and the second was an objective evaluation after the visit. No purchase or commitment would be made on-site at the breeder’s premises.

On the 20-minute ride to visit the breeder, the two girls were preoccupied on names for both males and females. Several reminders were made regarding the T&E process, with the promise (threat) that no puppy would be acquired today if the funding stakeholder (me) was not satisfied we had objectively evaluated the puppies under consideration.

We arrive to be greeted by several older puppies from another litter. Both my daughter and her friend immediately fell in love with, and wanted to take home, one of the older puppies. The breeder politely explained that these puppies were already promised to other homes, and that the puppies we came to see were inside. (It helps to have your supplier re-focus your user!) There were eight puppies, but one already had a deposit on it, leaving seven others (five females and two males) available. The girls spent time with all seven, carefully evaluating them. Then, as part of the process, they spent time with both the dame and sire (mother and father).

After almost an hour of evaluation, we reviewed the conditions of acquiring one of these puppies with the breeder, and then departed home. My daughter had down-selected to two puppies, one from each gender. Her final decision, with help from her friend, was to decide on whether she

wanted the male or female. The other stakeholder (I) remained neutral, and explained that whichever puppy she selected would meet my approval. Her immediate solution was a half-serious plea to get both puppies, and was quickly nixed (everyone probably saw this coming). Reminiscent of the ride to the breeder, the primary criteria for determining which puppy would be acquired ultimately rested on determining the “coolest” male or female name.

### **“What’s in a name?”**

After arriving home, the final decision was made to purchase the male puppy, and name him “Twister.” We called the breeder, put a deposit down on-line, and immediately set about acquiring support equipment. More than one full week before Twister was due to arrive, we had acquired a crate, personalized bed and food mat, and several other puppy essentials.



### **Operation and Sustainment.**

Not to neglect the operational roll-out, we are currently building a training plan, and preparing our home for the arrival. The training plan originated from two books on training puppies, one of which dealt specifically with Beagles. From the logistics standpoint, we have been planning

which areas of the house will be off-limits, and already have a “bed-down” location in place. Additionally, we are procuring supplies for the initial operational capability, and future support.

### **Summary.**

During a break at the most recent INCOSE International Symposium, a discussion ensued regarding the need for introducing the younger population to the SE processes. While my daughter may not grasp the SE Engine or V-Model, she fully appreciates the process that is delivering a new puppy to our home. Twister served as an ideal context for teaching my daughter systems engineering, with the ultimate reward of having a new puppy.



## **BIOGRAPHY**

Randy Bullard has held various positions as chief/lead engineer, senior analyst, and program manager in over 23 years of US government service. His education includes a BE in Mechanical Engineering from North Carolina State University, and a MS in Operations Research from the Air Force Institute of Technology. He is certified as a CSEP-ACQ.