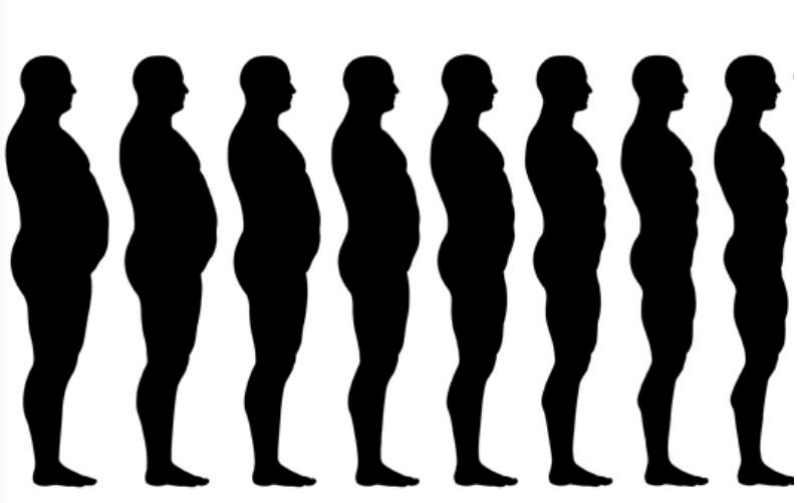

Fat Control the Lean Six Sigma Way

By Richard G. Lamb, PE, CPA, ICBB; Analytics4Strategy.com

The first absolute of Lean Six Sigma is to choose projects which will make the greatest difference. Let's relate the rule of projects to those we can personally identify with. What projects can we select that would improve the lives of those we love and work with by how we chose to live ours?

Always on a very short list of candidate projects would be "fat control." The immense ramifications of fat control are heavily researched and widely published. Furthermore, fat control is highly measurable and controllable in current time through its causal variables.

Just as compelling, achieving fat control is an undeniable problem. The evidence is that two thirds of the American population is now overweight and obese. We can readily observe that those who are successful in so many arenas fail miserably at fat control. This is even though most of us desperately want and need to succeed.

Something is wrong. We seem to be helpless. Is it because we are not applying the principles and practices of Lean Six Sigma to the problem? This article will describe what that looks like and why it succeeds. The explanation will be follow the five stages of define, measure, analyze, improve and control (DMAIC).

Stage 1: Define.

Before we miss a meal in the name fat control, the project needs to be defined such that others can see exactly what we are up to, chose to support us or, best of all, decide to join us. The stage will establish the problem statement, project purpose, scope, deliverables, sponsor and stakeholders, team members, schedule and other resources.

Problem statement: Most of us carry unwanted excess body fat and, worst, are proving to be ineffective in our ability to lose it. This project defines "excess" as the level of fat at which we are unnecessarily at risk of serious afflictions.

There are three types of fat—essential, subcutaneous and visceral. Essential fat resides in our organs and is permanent. Subcutaneous fat is what we see because it resides beneath our skin. As shown in Figure 1, visceral fat surrounds the organs in the stomach cavity and its magnitude is highly correlated to subcutaneous fat.

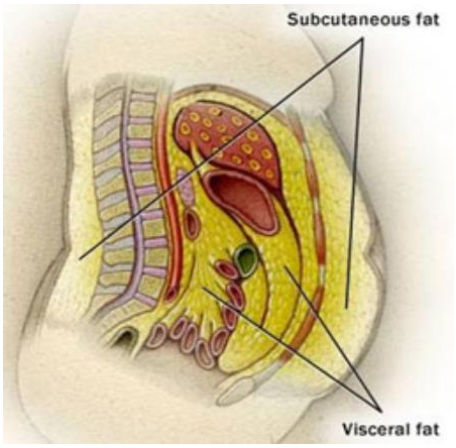

Figure 1: Visceral and subcutaneous fat.

The central issue is that visceral fat does more than make our cloths tight. It changes how our bodies operate; and not to the good.

Visceral fat is strongly linked to the risk of heart disease, cancer, stroke, dementia, diabetes, depression, arteritis, sexual dysfunctions and sleep disorders. It encourages reflux as it squeezes the stomach. It is also a precursor of abdominal hernias due to the stretching forces it exerts across the abdominal muscles. As part of overall body weight, it plays in the risk of joint failures. Hand in hand with the loss of quality of health and longevity, there is the considerable financial loss of poor health.

The clear strategy for reducing the considerable risk, to the extent we can control it, is readily apparent in the figure. Achieve and maintain a flat stomach for the rest of our life.

Purpose of the project: The project will design and put in place a permanent process to plan and control, in current time, our ability to reach and maintain a flat stomach.

Project scope: The scope is body fat control. It is not weight control, fitness and nutrition. These are related health issues, but we will work strictly to measure and manage body fat.

Top-level process: There is no apparent process to describe at this stage. The observed tendency is to operate on guidelines instead of process. Examples are avoiding certain foods and being "good" between Monday and Friday.

Deliverables: The final deliverable will be a fat control process. It will exercise current-time control at each intake of calories against a set daily limit. The daily limit will be set upon the

science of lean body mass and activity. Control will be placed on the causal variables to pounds of fat rather than the lagging variables.

There are three intermediate deliverables. First are the skills and system to count calories as we consume them. Second are the skills and system to determine how many calories our day requires as a function of lean body mass and composite activities. Third is to design our eating lifestyle with respect to the caloric density of what we will eat each day.

Initially, we cannot put numbers on the deliverables. The stages of define, measure, analyze, improve and control (DMAIC) and the working designed process will determine and set them. However, we can set a milestone visual measure at which we will know the final deliverable when we see it. It is to achieve a flat stomach, although it need not be a six-pack.

Sponsors and stakeholders: We as individuals are the sponsor of our own project. If we are not committed and willing to live the process for the rest of our life, no one can do it for us.

The stakeholders are those we love, are responsible for and work with. I leave to each reader to define why they are stakeholders in the process. If we do not puddle-up as we think it out, it is a sign that we are not a motivated, committed sponsor.

Team members: We may be the sole designer and enactor of the delivered process. However, team members are those around us that agree to support aspects of the process or, best of all, adopt the process along with us.

Schedule: The project schedule is charted as milestones to reach a flat stomach. The work breakdown structure (WBS) of Figure 2 shows the subprojects that must be accomplished along the way.

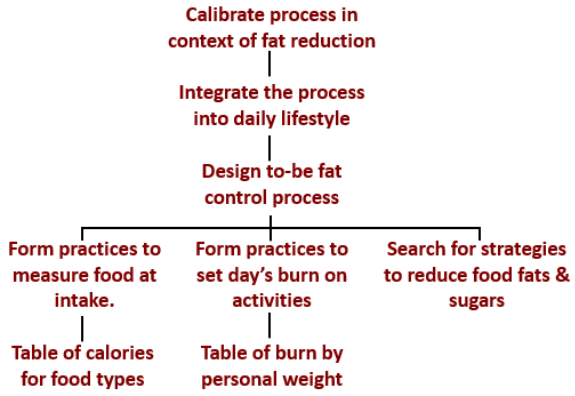

Figure 2: Work breakdown structure to achieve fat control.

At the bottom level, there are three accomplishments that converge at forming the to-be process for fat control. They are concerned with learning to measure caloric intake, learning to determine our calorie burn and finding strategies to reduce fat and sugar calories (caloric density) of our foods.

After designing the overall process to incorporate what has been learned, we will work the process in order to learn two things. As a pilot project, the first thing is how to integrate the process into our lifestyle. The second is how to calibrate the caloric burn of activities to our true lean body mass.

The WBS is translated to a trend line schedule in Figure 3. The current trajectory can be forecast upon our past. At Milestone 1, we have worked up to charting the process. From there to Milestone 2, we spend a multiple-month period until getting accustomed to living the process. It is noteworthy that we will stop our upward trend in body fat beginning at Milestone 1.

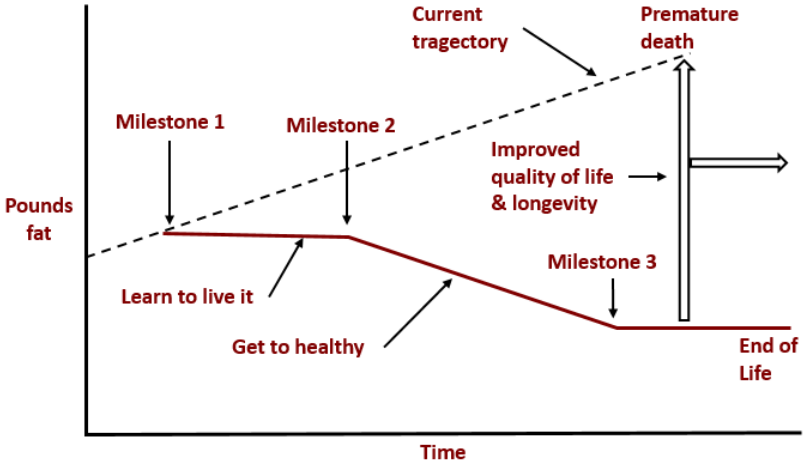

Figure 3: Schedule for reaching a flat stomach.

At Milestone 2, we embark upon our campaign to reach the flat stomach. At this milestone we set how many pounds we are to lose each month along the way. We translate that to the day's calorie limit. Meanwhile, we will conduct cycles of calibration to assure that we are losing fat at an expected rate. We also use our stomach as a visual measure along with others to assure our progress is real and our analytics are accurate.

Finally, at Milestone 3, we return to the normalcy we experienced and grew content with between Milestones 1 and 2. We will be controlling calories at the level we must until our life ends. The difference between the first period and this period is that we have learned and confirmed that our assessment of calorie burn is accurate—we know our body.

Other resources: It is conceivable that we will want to engage other resources. For example, there are measuring systems to test that there is change of steady-state.

An example is Bod Pod for body density. It is the best available measure of body fat relative to water immersion as the gold standard. However, its results are questionable in the range of extreme obesity and lean. Within the range, it is a good measure of lean body mass. All along, the density reading shows progress largely without distortion of outlying body fat percent.

Unfortunately, the equipment is not geographically available to everyone—check on online for locations. It costs approximately $50 to conduct the procedure.

Stage 2: Measure

The purpose of the measurement stage is to establish how we will measure all that must be measured to control pounds of fat. Thence, the objective is to apply the system to measure were we are now.

The stage normally begins with charting the as-is process and measuring its effectiveness. However, the previous stage recognized that process is typically more akin to loose guidelines. Of course, this is to be expected because, as Lean Six Sigma demonstrates, it is why we do not have a flat stomach and our body fat is drifting upward. The improve stage will set out a detailed process in which the measurements of this stage are its controls.

Measurement System

The deliverable of the fat control process is to reach and control pounds of fat. The pinnacle measure of success is visible. It is a flat stomach.

Our measurement system will be built upon the gold standard of any control. It is the current-time control of the causal behavior that leads to body fat. This of course, is calories consumed with respect to each day's calorie burning activities.

The quantitative measures related to a flat stomach are direct and calculated. The direct measures are by tape measure and weight scale. With tape, we will measure height, abdomen at naval (male), abdomen at narrowest above the naval (female), neck below larynx (Adam's apple), hips at widest and thighs. By scale we will measure body weight.

The calculated measures quantify body composition. From calculated body fat percentage, we can decompose the scale weight into fat and lean mass (muscle, organs and bones).

Body fat percent is the percentage of the body that is fat mass compared to total fat and lean mass. We can use an empirical calculation developed by the U.S. Navy. The gender-specific calculation (based on inches) of body fat percent (BF%) are:

Female:
BF% = 163.205*LOG((abdomen+hip-neck)*2.545)-97.684*LOG((height)*2.545)-78.387

Male:
BF% = 86.01*LOG((abdomen-neck)*2.545)-70.041*LOG((height)*2.545)+30.3.

The formulas are regression analyses for which the predictive variables are the previously taped measures. Notice that the calculations are independent of scale weight. This is because the dependent variable is the densitometric determination of body fat percentage.

Densitometric measurement includes water and air displacement to compute body density. In turn, the measure is the predictor variable to two regressions (Brozek and Siri) that predict body fat percent upon the density.

Because the previous formula is actually two models joined together, the calculation includes the random error of both. Furthermore, there are lurking variables in body fat percent; making the calculation individualistic.

Consequently, we are not looking for an exact percent. Instead, we seek a measurable short-term confirmation that we are losing body fat. We can also use the percentage as an index for calibrating calorie burn to our own lean body mass.

A best possible measurement system will measure a truly causal variable in current time. More specifically, at the end of each day we need to be able to measure if our body fat has remained unchanged or by what part of a pound did it decrease or increase.

The way to know is to measure each day's calorie burn minus calories consumed and divide the difference by 3,500 (calories in a pound of fat). Accordingly, we need two components of measurement—one for calorie consumption and the other for calorie burn.

Measuring calorie intake has become easy. Package labeling is required by law in most countries. For flexibility and accuracy, I advise using a food scale rather than volume. The best measurement scale is calories per gram. It is easier to think in tens than ounces and food packages typically only report in grams. Additionally, our smart phones readily give us calories for food components and items. For eating away from home, we will have to learn to estimate based on what we learn from measuring or what our smart phone can give us.

The other side of the analysis of difference is a bit harder to do. We need to tabulate the day's burn as the composite of activities over 24 hours. We can form a calculation to adjust published burn assumptions for a long list of activities. One is the Harvard table of activities and burn for 30 minute intervals.

However, our measurement system needs to adjust the burn for each activity to our personal characteristics. They are difference in "essential fat" for genders, our percent body fat and our scale weight.

Essential fat is what our body contains within its organs. It is approximately 8 percent greater for women than for men. Activity burn tables do not make the distinction.

Our measurement system will assume that body fat percent behind the table are 26 percent for women and 18 percent for men. These are the threshold percentages of normal body fat published by the American Council on Exercise.

The general calculation is the activity calories adjusted for gender, personal body fat percent and total body weight. The gender specific formulas for non-carried-weight activities are:

Female: Calorie burn=ActivityCal*0.96*(26/BF%)*(Weight/WeightColumn)

Male: Calorie burn=ActivityCal*1.04*(18/BF%)*(Weight/WeightColumn)

The ActivityCal term is the calories taken from the chosen table with weight columns such as 125, 155 and 185 pounds. The calorie burn calculation can be adjusted to any number of

activity minutes. The terms 0.96 and 1.04 and are the gender adjustment for essential fat. The terms 26/BF% and 18/BF% are adjustments to for relative lean body mass. The Weight/WeightColumn term is the ratio of personal weight to the table weight.

The calculation must be adjusted for weight-bearing activities such as walking, running and yard work. For such activities, the body fat percent term is omitted.

We should never hang our hat on a rule-of-thumb, including our doctor's. In my case, the rule of thumb would cause me to gain approximately ten pounds a year. At that rate, according to Body Mass Index, I would be overweight in just over two years and obese in just over five years from my currently very lean 11.5 percent body fat.

Plan to Gather Data

Of course, we want to take our first measures at this stage. We also want some pictures that clearly show our initial condition.

On a daily basis, we will monitor calories consumed, as a list of eaten items. My low-technology list is shown in Figure 4. We will set up a running Excel table that compares each day's consumed calories to our 24-hour composite of burned calories. In the table we will divide the difference by 3,500; the calories in a pound of fat. The result is to measure if we gained, lost or maintained body fat today.

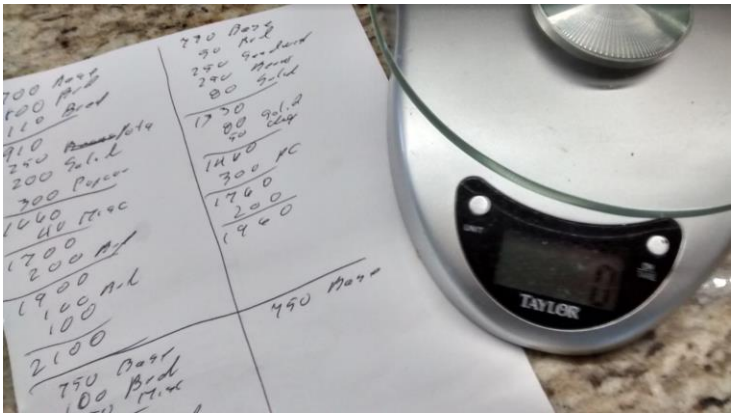

Figure 4: The day's calories are recorded when consumed.

Initially and weekly we will take body tape measures. With them we will calculate body fat percent and pounds. Scale weight should be taken daily under the same daily conditions. As we do, we will chart the body measures and calculated body fat percent and, in turn, carried body fat. We will compare the scale weight what the running daily comparison tell us it should be.

The plan for data gathering can be aligned to the scheduled stages of Figure 3. During the initial stage and fat reduction stage, the entire measurement system will be active throughout the flowcharted process (Figures 5 through 9). A parallel purpose to actual fat reduction is to confirm that our measurement system is calibrated to our body composition and activities. In other words, we are learning to measure accurately.

When we have reached our flat-stomach steady state, data gathering can be reduced to only keeping a daily score sheet upon which to record calories as they are eaten (Figure 4) against the day's burn. We close the kitchen when the limit related to calorie burn is reached. If this is not done religiously, we run the risk of regaining the fat.

The final data gathering requirement is the "you play, you pay" rule. In the process of fat control there is no "day off." If we eat past our set daily limit, it must be carried over to the next day's score sheet of consumed calories. In other words, we open the day's calories sheet with a beginning balance toward the day's limit.

Stage 3: Analyze

The purpose of the analyze stage is to explore the gap between where we are currently and where we wish to be for the rest of our life. In turn, we want to analyze what holds us back and search for permanent solutions.

For most of us there is no substantive process to evaluate at this stage. If there were process, we would evaluate it with respect to how we will close the gap between what we want from it and what we are getting instead.

The combined eating log and burn spreadsheet are our analytical foundation. With them we can conduct considerable analysis of our facts and behaviors. We can also will take initial action even though the fat control process has yet to be designed.

Now there is a long list of questions to answer. The **first set of questions** defines where we are now. What is my estimated percent and pounds of body fat? Am I overweight or obese and, thus, at immediate risk of serious health problems? How many calories of deficit must I create to get below overweight and then to a flat stomach using 21 percent for women and 14 percent for men (lean per American Council on Exercise) as my initial body fat percent target.

The **second set of questions** probe how we are now changing physically. Am I on a trend of gaining body fat? If not already, when will I become overweight and then obese? From here, how long would it take me to get to the initial flat-stomach-percent at various levels of daily deficit.

A **third set of question** is social. Do I have a support system at home? If not can it be improved; the best case being that the entire family participates in the fat control process? Is my work environment insensitive to my need to control body fat and, in fact, presents constant temptation?

The **fourth set of questions** are directed at food ingredients. Which types of items eaten each day most affect my total calories? Are there alternatives to them that are fat free or low fat and no sugar? Can I construct an alternative and like it? For example, can I learn to love a cheeseburger made of 4 percent fat beef, no fat cheese and no-sugar bread? When I eat out, how will I determine my calories and can I think of strategies for sharing or saving calories?

The **fifth set of questions** are directed at self-awareness and self-discipline. Where do I fall down from my eating programs? What can I do to get past temptations? What mental justifications do I use when falling to temptation? What tricks work to distract me from succumbing to temptation; for example, the pastry baker who chews gum while working.

At this stage we have considerable quantitative insight into where we are and how quickly we can get to a flat stomach. Of course, each of us have additional questions we would know to ask of ourselves.

Stage 4: Improve

The purpose of the stage is to improve the process capability. To achieve and maintain a flat stomach, for most of us, we are either designing a process where none existed or extending one that is minimal. The one fundamental conclusion we can have of existing processes is that, whatever they are, they have proven to be ineffective.

Accordingly, the article will offer a process. During the stage, a pilot project is considered to be a best practice. In this case, the pilot will be distinguished by focusing on the routine remaining-life enactment of the process rather than embarking on our campaign to reach a flat stomach.

The Flat-Stomach Process

Figure 5 shows the subprocesses to achieve and maintain a flat stomach. Each will be summarized individually.

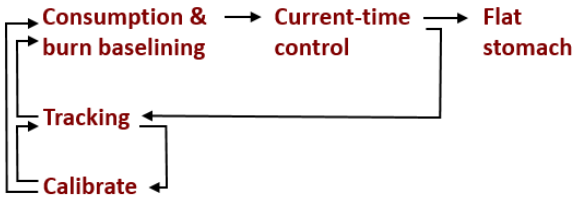

Figure 5: The subprocess to reach and maintain a flat-stomach.

Notice we set a baseline for computing the balance between calorie consumption and burn. It is calibrated as time passes. We then control calories, one serving at a time, throughout the day. If we are in the mode of losing pounds, we track the deficit as a running total of lost pounds. Finally, there must be a process to calibrate the consumption and burn calculation. The calibration compares the actual pounds of change expected compared to the computed pounds of change.

Figure 6 charts the **consume and burn baselining subprocess**. Along the top stream, we identify our data source for calorie burn related to activity and weight, develop a formula to personalize the calculation and form a reference table for the activities of our particular lifestyle. Finally, we estimate the calories required for our lean body mass to maintain a flat stomach. Along the bottom stream we identify our data source for food calories, learn to be good at counting calories and develop a daily routine for counting.

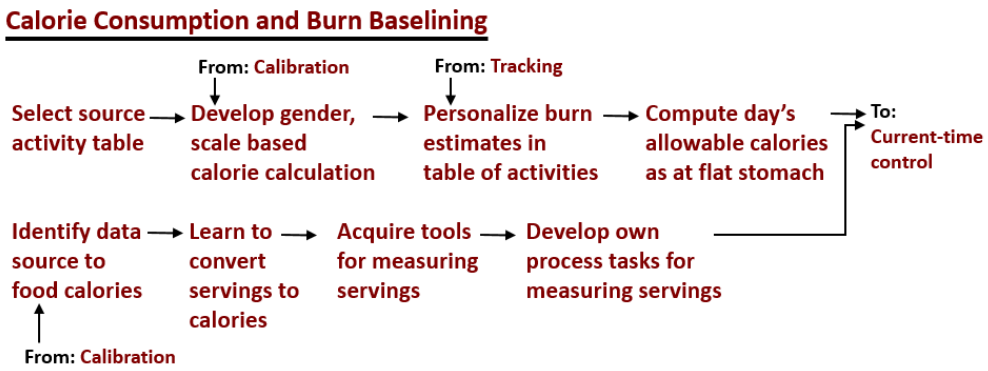

Figure 6: The subprocess to set calorie consumption and burn baselines.

Figure 7 charts the **current-time control subprocess**. Notice two streams depending upon whether we are moving toward our end-state or maintaining a flat stomach.

If we are moving to a flat stomach, the upper stream establishes a date to reach it, the total calorie deficit to reach it and the day's limit after allowing for deficit. From there we converge into the lower stream.

The lower stream plans the day upon activity and eating, and counts each serving's calories. It also carries calories over to the next day if for some reason we do not stop at the day's control limit.

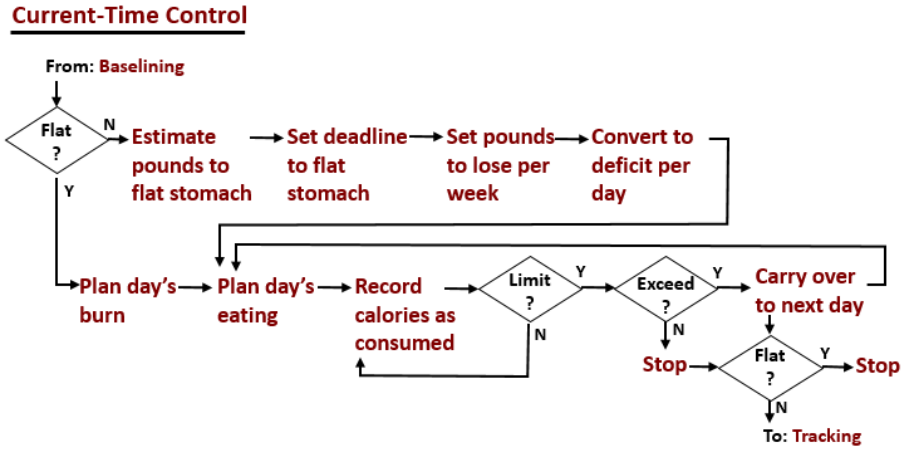

Figure 7: The subprocess for current-time control.

Figure 8 charts the **tracking subprocess**. It adds the daily deficit calculated by the current-time control subprocess to a running total of reduced pounds to date. If our actual lean body mass and baseline activity burns are accurately calibrated, the running total is the most accurate here-and-now measurement against the goal to change or maintain pounds of fat.

We design an Excel table to track all of the measurements and calculations per the date of record. Thence, the running results go to the recalculation of our changing body fat percent. It will be used to adjust our personalized activity burn table. Just as noteworthy, the results also flow to the calibration subprocess to evaluate and improve our ability to measure consumption and burn.

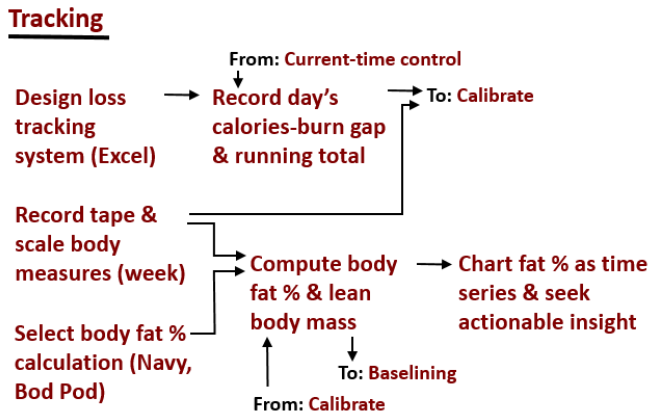

Figure 8: The subprocess to track progress to a flat stomach.

Figure 9 charts the **calibration subprocess**. Calibration starts by comparing actual and calculated running total loss. Of course, if we are maintaining, we would expect the scale weight to be constant.

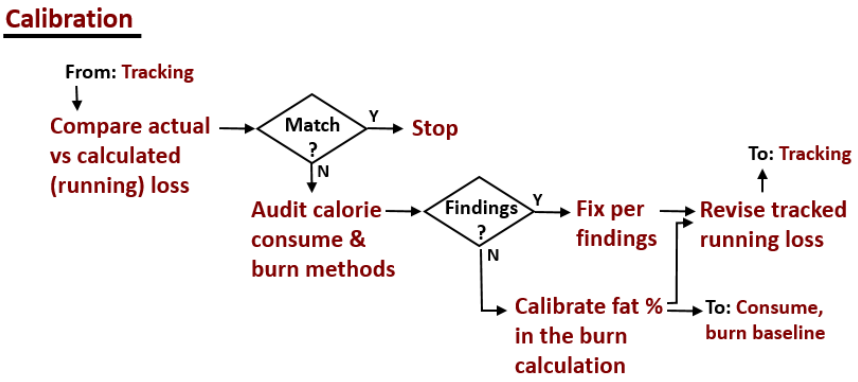

Figure 9: The subprocess calibrate computed to actual fat loss.

If there is a significant mismatch, the subprocess will audit the consumption and burn baseline proceses, as well as, our personal integrity. If there are findings, they will be rectified. In turn, the running total to date will be adjusted to correctly locate our fat mass.

If there are no findings, but a mismatch, we need to calibrate the body fat percent to burn calculation in the baselining subprocess. Furthermore, we will get a tighter knowledge of our personal lean body mass. This is an important insight because lean mass remains essentially constant with a life style that includes strenuous exercise and slowly declines with anything less than strenuous.

Pilot Project

The process looks right, but how efficient will we be in its consistent enactment? A pilot project should be conducted to test and refine the process around achievable, disciplined consistency.

The intent of the process is that only a short period of our remaining life will be in the mode of fat reduction. The rest must be eating as we should; no more, no less. Accordingly, the pilot will allow us practice our remaining-life eating lifestyle.

What I mean by that is to get used to eating what we will eat once we get to our flat stomach. During the pilot, as individuals, we work on our eating day until it becomes comfortable to us. This is an essential accomplishment because it is what we must be committed to until our death beds. Along with that, we will get accustomed to measuring in preparation for a meal, dealing with unstructured meals, recording the day, tracking change and calibrating the burn assumptions.

The pilot should run for several months until it becomes a way of life—our new satiated and procedural normal. During this time our percent fat may fall slightly. That is if we are overweight or worse. This is because we are carrying a greater load than we will at the flat-stomach level.

The pilot has a practical reason for project success. When we go into the fat reduction phase, if our routine deficit is reasonable, we will not be miserable as we progress. This is because it is only a shift from what has become normal eating rather than a much larger shift from the gluttony of our past.

Stage 5: Control and Verify

So far we have done a pilot of the process. The objective was to evaluate how practicably we can make it integral to our daily functioning, procedures and habits. More importantly, it has been tested with respect to discovering that the daily calorie consumption is well within the range of satisfying oral and emotional gratification.

Now to move into the stage of reducing our body fat to a flat stomach. Now we need to verify that that the process will take us to a flat stomach and set all of the measurable factors for maintenance. My own experience serves as both.

I started the fat control process at 170 pounds on a 65.5 inch frame for which 168 pounds is the threshold of obese. Obese begins at 30 percent body fat for males and 40 percent for females. This translated to 51 pounds of fat, of which up to 10 pounds was essential fat.

Ultimately, I found that my flat stomach falls between 135 to 140 pounds. However, I chose to reduce and hold at 131 pounds; a total reduction of 39 pounds.

At the time of enacting the process in June 2005, I had not yet thought of the idea of the pilot project. Instead, I reduced my daily intake by 1,200 calories below my maintenance level. I had scheduled myself to reach the setpoint in four months to be ready to walk to the bottom of the Grand Canyon and back up in September. This required that I lose around 10 pounds per month—I will never do that again.

Through the cycles to reach calibration, my day's maintenance calories emerged as 2,200 calories per day. This is based on running three miles four times a week and strength training three times a week. However, what is extremely noteworthy to us is that published burn tables

would have recommended 2,400 to 2,600 calories per day. My doctor recommended 2,400 calories as his rule-of-thumb.

Getting this number correct through the calibration procedure is extremely important. Each surplus of 100 calories (e.g., one apple) would increase my fat content by 10 pounds a year (100 calories*365 days/3,500 calories per pound).

Since 2005, I have maintained 131 pounds. The Navy body fat calculation classifies this as lean (15.4 percent). However, displacement density testing (Bod Pod) measured my lean body mass (118 pounds) to be such that my true classification is very lean (11.5 percent). The difference reflects that my muscle mass is approximately 7 pounds greater than the mean for males with my neck and abdomen (at the naval) dimensions.

Once the calibrated measured set points are established, the most important control in the process is the current-time control. For a large part of 2015, I violated the process rule of writing down calories throughout the day (Figure 4) and, instead, kept the day's current-time running total in my head. Because I rely on the current-time control rather than scale measure, my weight crept up to 138 pounds. In other words, the visual measure (stomach) showed good, but by my body fat was on the move.

This sent me back to the fat reduction mode of the control process until getting back to 131 pounds. I did so with a 500 calorie per day deficit; approximately 1 pound per week. Given my history with eating at my normal caloric setpoint, I found that the deficit was easy to take in stride.

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