Washington D.C. Region SCCA

and

The MGs of Baltimore, Ltd.

Road Rally Handbook

Rally School

Presented by the WDC Region of the SCCA and MGs of Baltimore

PURPOSE: To prepare students to understand the basics of Time-Speed-Distance (TSD) Rallying and make their rally experience more enjoyable on future events.

COURSE OUTLINE: (Note: sections of this text will be skipped in the course, and we hope that students will refer back to this reference from time to time to revisit topics that might be of interest as they progress in their rally experiences)

1. Welcome and Introduction
2. Determine experiences in the class and what students are looking for in the class
3. Basics of Working Together in the car OR How not to kill your rally partner
4. Types of RoadRallies
5. Types of Checkpoints (controls) that may be encountered and what to do at them
6. Car and Crew Preparation for a rally including what to bring on a rally
7. What should you take away from General Instructions (GIs)
8. Route Instructions - How to stay on course
9. The Odometer Calibration leg and its importance
10. Staying on time
11. Sample Rally
12. Debrief from what teams saw while running the rally
13. Final Questions

Section 1: Overview of the Course

Table of Contents for this Book

Section 1 Overview of the course, Rallying Websites and Contacts

Section 2 Progression of Rally Teams over Time

Section 3 Division of Duties between Driver and Navigator, Useful Skills for these Jobs

Section 4 Types of Rallies

Section 5 Types of Controls

Section 6 Preparing for Rallies and Keeping a Rally Box

Section 7 General Instructions and What to Look for in them

Section 8 Types of Route Instructions

Section 9 Understanding the Odometer Calibration Leg and Odometer Calibration Factor

Section 10 Basics on Keeping Time during a Rally

Section 11 Time Allowances and how to Use Them

Section 12 Information on Rally Etiquette and Today's Rally

Appendix A Glossary of Rally Terms

Appendix B Useful Formulas for Navigators

Appendix C Details about Rally Equipment (Clocks, Odometers, Speedometers, etc)

Appendix D How to Plot Map References

Appendix E How to Run Monte Carlo Style Rallies

Appendix F Advanced SOP Timing Techniques by Elliott Woodward

Appendix G EZ Timing Method for Calculating Times

Appendix H How to Score Yourself on a Rally

Appendix I Overview of Rallying by Dennis Blevins and Gary Starr's Tips for Beginners.

Rallying within 100 miles of Baltimore / Washington

You are fortunate to live in an area where within 100 miles; you can find a very wide variety of rallies, put on by some very experienced rallymasters. Not only do we have local MGs of Baltimore events such as Get the Dust Off (in May), but we also have numerous SCCA Regions with significant RoadRally programs. These regions include Philadelphia, South Jersey, North Jersey, Old Dominion, and our local Washington, DC region. In addition, the Philadelphia, South Jersey, and Washington, DC regions also have events.

We have included contact information on these various regions events below.

Washington, DC Region SCCA: http://www.wdcr-scca.org Click on RoadRally to get to the home page with the latest schedule. This year the region will be hosting the US RoadRally Challenge in October, including the novice-friendly Catoctin Monte tour rally, as well as a course rally and a GTA (Gimmick) rally.

South Jersey Region SCCA: http://www.sjr-scca.org/rally.html This region runs Saturday evening tour rallies and Sunday afternoon course and tour rallies. In addition, this region is picking up the Pine Barrens Express Rally, which is held in October or November each year running, in part, through the cranberry bogs starting in the afternoon and continuing well into the night.

North Jersey Region SCCA: http://www.scca-nnjr.org/NNJR_Rally/Rally.shtml This region organized the Pine Barrens Express rally up until this year. Their rallies are predominantly tour events.

Old Dominion Region SCCA: http://www.odr-scca.org Click on Road Rally for more details. This region focuses on tour rallies and also runs the occasional GTA event.

How To Rally Websites

The Internet is a fabulous resource for learning how to rally. The following are some web links to start your search for information on rallying.

Clint Goss's Road Rally Resource Page: http://www.goss.com/rally.htm This website includes the basics of RoadRally, has a Find-A-Rally resource that some use to post their upcoming events, and includes information for navigators running the EZ Rally method or using tables.

Monte Saager's Oregon based Page: http://www.tsdroadrally.com This website includes great information on topics such as going on your first rally, how to stay on time and on course, and basics of trap rallying.

Scott Harvey's Beginner's Guide to TSD Road Rally: http://detroit-scca.org Click on TSD Rally then go to the bottom of the page for the five part introduction.

South Jersey Region SCCA introduction to TSD RoadRally (written by Jim Wakeman, Sr): http://www.sjr-scca.org/rally.html Go to the bottom of the page, below their schedule, to find the links to a 4 chapter How to Rally Booklet.

Who can I contact with Rally Questions?

We are very lucky in the DC Region to have a number of people with a broad range of experiences that you can go to with questions. A summary of experienced people is below, each of whom is happy to answer your questions about road rallying. There are many things that come up when you actually go out on the road that you may not have expected, and they can talk you through those topics so you are more prepared for the next event.

Steve Gaddy - nittany1995@gmail.com. Winner of numerous SCCA National Championships and US RoadRally Challenges. Tour and Course Rallyist and knowledgeable about US map rallies. Can provide useful information about rallying with equipment and/or a computer.

Len Picton - LenPicton@aol.com. Current WDC Region Rally Chairman. Tour rallyist and knowledgeable about UK map rallies. Organizer of numerous events and has extensive knowledge about car preparation and navigation equipment for historic cars.

Dennis Blevins – lucas2mg@yahoo.com. MGs of Baltimore and Lanco MG Club. Past Northeast Division Champion Navigator in Stock Class. Knows several methods of calculating with "pencil and paper." This is a useful skill for those who want to take the next step without spending hundreds of dollars on equipment.

Eric Salminen – mgobrallymaster@gmail.com MGs of Baltimore. Past Northeast Division Champion Driver in Stock Class. Can help drivers in what to focus on. Also, an experienced rallymaster that can offer tips on what to watch for when participating in various rallies. (Every rallymaster has their own "tricks" and sets things up differently.)

Section 2: Progression

At your first event(s):

- Read everything in your packet (GIs, Route Instructions, additional info)
- Synchronize your watch with the official rally clock at the start
- Ask questions of the organizers (or even of other contestants that seem knowledgeable) before leaving
- If you are given key times in the routes, leave at key time plus your car number
- Drive between 2 and 3 miles per hour over the given CAST when you can (to make up for delays in curves, at Stop signs and intersections, etc).

Once you are comfortable with route following and rally basics expand to a Recreational level:

- Do the first three from above plus
- Use Odometer Calibration Factor to adjust the official mileages and CASTs
- Use a stopwatch method for getting back on time at pauses and delays
- Find a way to mount a clipboard in the center of the car so both driver and navigator can read the route instructions easily
- Find better ways to distribute the workload during the rally that work for you
- After the rally, determine what worked and what didn't. Write up a few lessons learned and add to your rally box for review prior to the next event.
- Start using Time Allowances when needed to make up for delays on route. Review background on TAs in the handouts to prepare for using TAs if you need to.
- To keep harmony in the rally team, agree to "One yell" per rally for mistakes.

After you run 10-20 rallies, you will face a decision.

Do you stay recreational and focus on having fun out on the roads?

Do you stay recreational but try to continue getting better by trying to focus on one aspect per rally?

Do you have the navigator focus on computational methods for keeping the team on time?

Do you spend $300 - $1000 on equipment that will do the computations for you and move to either the Equipped or Limited class? (Or nowadays – find an app for your smart phone or tablet and possibly an external GPS pickup unit and invest the time learning how to use it proficiently.)

Section 3: Division of Responsibilities

The following is a typical division of responsibility for a new rally crew. This frequently occurs when a married couple comes out for their first rally (we have seen this numerous times!)

Driver	**Navigator**
Turn right (left) as directed	Read General Instructions prior to start
Remember current instruction	Read Route Instructions to driver
Travel at the speed directed	Synchronize watches with master clock at start
	Highlight speed changes, pauses and gains in routes
	Calculate Odometer Correction factor on route
	Use correction factor to revise CASTs and mileages
	Inform driver of speed changes
	Keep time and advise driver to speed up/slow down
	Countdown to all key times
	Interact with timing crews (if necessary)
	Perform all scoring tasks

Which job would you want???

How can these responsibilities be more evenly divided? Here is one way. A helpful thing needed for this is to find a way of mounting the route instructions in the middle of the dashboard (between driver and navigator)

Driver	**Navigator**
Read General Instructions prior to start	Read General Instructions prior to start
Read Route Instructions at start	Read Route Instructions at start
	Synchronize watches with master clock at start
	Highlight speed changes, pauses and gains in routes
	Calculate Odometer Correction factor on route
Help navigator to correct CASTs and mileages	Use correction factor to revise CASTs and mileages
Read route instructions off clipboard	Help driver with turns and staying on CAST
Drive to corrected CASTs	Keep time and advise driver to speed up/slow down
	Countdown to all key times
Interact with timing crews (if necessary)	Interact with timing crews (if necessary)
Perform any scoring tasks	Perform any scoring tasks

Clearly if the driver can work more closely with the navigator, it will make the experience for the navigator much more pleasant and will likely lead to a navigator who is willing to come back for another rally.

Useful Skills for Drivers and Navigators

There are two levels of rallying that we discuss in this course.

For a **fun rally team**, where you are looking for a fun adventure and an enjoyable afternoon drive:

Driver qualifications:

1. A driver's license and a car

2. Capable of listing to the navigator and remembering what they were told

Navigator qualifications:

1. Some organizational ability (to handle the paperwork and keep track of route instructions)

2. Not prone to motion sickness while reading in the car (if you do get motion sick, taking medicine prior to the event often allows you to still enjoy the event)

When either team member wants to become more serious about rallying, the list of skills needed increases from those above. For a **serious rally team**, where you are calculating or using a computer:

Driver qualifications:

1. Smooth driving. Abrupt or jerky motions make life more difficult for the navigator, and make it difficult to score well.

2. Good vision. Must be able to read routes on the clipboard mounted in the middle of the car and keep track of street signs and other things going on outside the car (not to mention, safely driving the car!). For some methods, the driver also has to give mileage hacks to the navigator from the stock odometer.

3. Good memory. Must stay on top of CAST and the current route instruction.

4. Good hearing. The navigator will be providing information frequently about timing that the driver has to internalize and then speed up or slow down.

Navigator qualifications:

1. Ability to concentrate in a moving vehicle.

2. Mathematical knowledge is a major plus, especially for teams doing calculations.

3. An enjoyment, if not love, of problem solving, especially for course rallies (this interest should also apply to the driver in course rallies). People who enjoy crossword or Sudoku puzzles are natural navigators.

Section 4: Types of RoadRallies

There are a wide variety of events that all fall under the basic description of a RoadRally, a competition that involves determining a course either on roads or maps. This definition is broader than most because there are lots of ways of enjoying this sport, and we don't want to eliminate any of them with this definition.

1. **Time Speed Distance Rallies (TSD Rallying)**. This is the most prevalent type of RoadRally. In a TSD RoadRally, teams must not only follow the rally course, but are also challenged to maintain precise average speeds. This speed is always at or below the posted speed limit for the roads used. At various points along the route, the cars will encounter checkpoints, where their times of arrival will be clocked. Teams are penalized, usually one point for every hundredth of a minute that they arrive early OR late at the checkpoint. At the end of the event, the team with the lowest score is declared the winner. Since all speeds are at or below posted speed limits, no special vehicle is needed. The rally usually ends at a restaurant so competitors can share rally stories while waiting for awards to be handed out.

There are two main TSD rally subcategories.

1a. Tour Rallies. These are the majority of the rallies you will see. These types of rallies are often described in flyers as basic TSD rallies, Monte Carlo rallies, and/or beginner-friendly rallies. In these rallies, the course is straightforward and your challenge is to stay on time. Everyone follows the same course, and by following the easy-to-follow instructions, you will make it through the course and get to the finish. The Monte Carlo rally (in most of the country) is a common sub-category of tour rallies, where instead of being given average speeds to maintain, and where checkpoint locations are not known, the routes include the correct time and location for EVERY possible checkpoint. This type of rally is very popular with beginners and recreational rallyists due to its simplicity, and the reduced calculations needed to do well.

1b. Course Rallies. In most areas of the country, these are a much smaller subset of rallies, which are often described as Trap or Course rallies. In addition, these rallies frequently have a difficulty level associated with them because the course is not obvious, and in most cases have multiple paths that rally cars can take, which have very different perfect times. The rallymaster's goal is to goad you into choosing the wrong path, while the contestant's goal is to understand, interpret and execute the rules to perfection resulting in their taking the correct path (all while staying on time). What makes this work is that all of the paths meet back up again prior to the next control. Those cars that follow the right path get good scores and those that don't usually end up with a maximum score. As such, until you are comfortable with timekeeping and other aspects of TSD rallying, course rallying is not recommended. If you are a puzzle person, however, there is a good chance that this type of rallying will appeal to you in the long run.

2. **Game-Tour-Adventure (GTA) Rallies.** These types of events cover all non-TSD RoadRallies. They are similar to TSD events in that you drive your everyday car on public roads, but the time element is usually eliminated (however, you might have a time you have to arrive at the finish by). These are also frequently referred to as Gimmick Rallies, and vary wildly from basic and laid back events to extremely complicated logic-solving events. Some examples include:

- **A Trivia Rally**, where teams answer questions based upon signs they see along the route.
- A **Shortest Distance Rally**, where you create your own route (usually stopping at several required interim points), with a goal of completing the event in the fewest total miles.
- **An A/B Rally**, which is generally very similar to a course rally, except the answer to multiple choice questions is used to determine whether contestants have taken the correct course.
- **A Scavenger Hunt Rally**, where teams are required to find objects or take pictures of landmarks in the area.

And many, many more!!

3. **Map Rallies.** While there are map rallies that are run on the road using a map instead of, or in addition to route instructions, these are often considered to be a subset of the rallies above. The map rallies discussed in this section are run "virtually" without ever leaving your house. These events generally appeal to the same types of people that enjoy Course or GTA events, and are great practice for running many of those events. Map rallies are run at your own pace, as you usually have a few weeks to a few months from the time you receive the instructions to return your answers. Depending on the event, you can either run them alone or as part of a small group.

The three main map events right now are:

St. Valentine's Day Massacre / Independence Day Fireworks / Circumglobal Trophy Dash - The Massacre has run for several decades, and along with the Fireworks, using the Rand McNally Road Atlas, while the Trophy Dash uses custom made and unique/historic maps. These events are very similar to Course/GTA rallies and are an excellent learning experience. For more details, check out http://home.earthlink.net/~oldmaltese.

Texas Table Top Rally - This is put on by Sasha Lanz in the SCCA Texas Region based upon the Roads of Texas map book. They have a great website, and you can track their events to determine when they will run their map event this year. Look for it at http://www.texasscca.org/rally.html.

Table Top Rallying - This is a UK site that uses downloadable copies of the UK Ordinance Maps. These are a very different way of plotting a course from most US events, but they are great fun and a real challenge. You can view old events or register for the remaining 2 events in the 2010 series by going to http://www.table-top-rallying.org.uk.

Section 5: Controls (Checkpoints) and Procedures

A control (which is used interchangeably with the term checkpoint) is a place along the rally route where your car will be timed or observed. As such, these are some of the most important places you will reach during the rally. There are three main types of controls that you will see when running rallies, and one other that we will mention in passing that occurs far less frequently.

1. **Open Controls**. This is a manned control identified by a checkpoint sign (usually a check mark followed by a dot). At this type of control, you will be timed by the control crew when your front tires cross the timing line and then you will stop **beyond** the timing line to get timing information from the control crew. **Never** stop on the timing line as you will interfere with the next car coming into the control. Open controls give you the opportunity to get information about how you are doing at the end of each leg.

2. **Closed (also called Passage) Controls**. This is a manned control identified by a checkpoint sign (usually a check mark followed by a dot, or sometimes a clock face). At this type of control, the control crew will time you when your front tires cross the timing line. Unlike Open Controls, you do not stop at the control. Usually these events have Key Times after controls, which allow you to restart at a known place and time further along the rally route. Passage controls give you less feedback on how you are doing, as you only receive timing information at the end of a section or at the end of the rally.

3. **Do It Yourself Controls (DIYCs)**. These are places along the rally route where the route instructions will direct you to time yourself when you reach that location. This can be done either by running the leg on time and writing down when you arrive or by calculating the proper arrival time (allowing you to run earlier than you would otherwise). The use of DIYCs allows the organizers to have more timing points than they could have with the number of volunteer control crews they can bring out. The standard rule is that your out time from a DIYC is exactly 2 minutes after your arrival time. Because of this, once you have determined your arrival time, make sure you pull ahead a few car lengths to allow the next car to pull up to the DIYC location.

4. **Observation Controls (OBS)**. This is not frequently seen outside of SCCA National Rallies, but they officially exist to observe the cars as they go by to ensure safety. In some events, the OBS control will appear at or near a break, and you will be directed to stop and exchange information with the control crew. Generally, however, you should not stop at an OBS unless you are told this is the case. If an event is going to use an OBS, its usage will be specified in the event's General Instructions.

Section 6: Preparing to go on a RoadRally

If you are a typical RoadRally contest, you likely only run one or two of them per year. As such, it is hard to remember everything that you need to bring on the day of the rally. We recommend you put together a Rally Box that contains all of the equipment that you need so that you don't forget anything.

Some of the typical equipment for your rally box includes the following.

- **Clipboard** (for the navigator to write on during the rally)
- **Highlighters** (for use on GIs and Route Instructions to highlight areas of interest for easy reference during the rally and to focus your attention on important areas). Many teams highlight all speed changes with a single color, gains and pauses with another, etc.
- **Basic 4-Function Calculator**, preferably with large buttons and a backspace key (for determining odometer calibration factors at first, and eventually expanding to additional uses in keeping the team on time.
- **Pens or Pencils**
- **Timekeeping device**, or a reminder to bring the appropriate watch(es) if you can't keep them in the box because of day to say usage
- **Large 9"x12" Envelopes** (for organizing all the paperwork that will be given to teams during the day at controls)
- **Blue Painter's Tape** (this is great for general purposes inside & outside the rally vehicle and rarely leaves residue when peeled off)
- **Notebook** (this should be used for you to record lessons learned, things to try on future rallies, information gleaned from other competitors, etc. If you only rally several times each year, this notebook will let you get back up to speed before running each rally and can be used to record things you want to try on future rallies. This is a great way for you to review with your rally partner as you drive to the start of the next rally)

Each team has their own things that they bring with them on rallies, so this is just a starting point for you. This should give you enough to handle most situations that arise while rallying.

Section 7: What to Look for in General Instructions (GIs)

General instructions give contestants the background needed to have fun during the rally. GIs have to be very detailed and precise in order to avoid arguments after the event, and as such they tend to be long documents (frequently 4 - 10 pages). For beginners, this can be a daunting document because there is so much information. Our goal in this section is to focus on what beginners should specifically look for when they receive their GIs.

Because of the length of general instructions, it is good to get them before the rally so you can review them and look for the items that we discuss in this section. If they are not e-mailed to you one week prior to the rally, you should contact the rallymaster (usually via e-mail) and ask for a copy. This will allow both driver **and** navigator to have more fun prior to the rally.

You should be aware that different clubs and regions do things a bit differently, so it is important to look at the GIs to make sure you know what you should be doing on the rally. The basic GIs that the MGoBs, SCCA DC Region, Delaware, NJ, and VA use are all different. However, if you key on the following topics, it will be easier to determine what matters in running the rally.

Checkpoint Type:

As you have seen, there are multiple types of checkpoints that are used on RoadRallies. There is always a section that describes how that rally will use checkpoints and how to determine what they are. Most rallies will use either Open or Passage controls (few will use both). As such, when you encounter a checkpoint sign, you will either stop just beyond the control timing line (for open controls) or continue on (for passage controls) based upon the GIs. If the rally uses Open controls, then the GIs will also indicate what information the control crew will want from you (for example, hand in a scorecard) and what they will give you (for example, your in time and next out time on the scorecard and a timing log which describes how the last leg should have been done).

If a rally uses DIYC controls, they will describe what you are to do at them. For example, you are asked to write down your in time for the DIYC leg and may compute the out time for the next leg by adding 2 minutes to your in time.

Route Following Priorities:

A series of route following priorities is frequently given to tell rally teams how to get through each intersection. We discuss a common route following priority list and why each of these items is there.

1. **Execute an emergency instruction or follow an emergency sign.** This is always the top priority in such a list because emergency signs/instructions are used to get teams through areas where signs are down or missing. A lead car frequently runs the rally in front of the contestants to make sure that all the needed signs are present, and if a sign is missing, they will put up a sign,

frequently on a colored paper pie plate telling teams which way to go.

2. **Execute a route-following action referenced to an official mileage.** If you have an official mileage, that takes precedence over other instructions. In a tour rally, however, there is rarely a distinction between 2 and 3 in this list.

3. **Execute a route-following action.** This simply says to follow an instruction when you can do it.

4. **Follow the main/principal road.** If there is not an instruction to take you through an intersection, you need another way to determine which way to go. This is discussed in more detail below.

Main Road Priorities:

The Main Road (also referred to as a Principal Road in tour rallies) tells contestants where they should go at an intersection when no instruction applies. Typically this is just the obvious continuation of your road in most tour rallies. This means following the same pavement surface, a curve warning sign, the center line on the pavement, or straight as possible. However, in more advanced trap events, the Main Road is used for numerous other possibilities. Other possible things that you might see include:

Onto - The main road follows the road designation that you were put on with the word onto.

Curve Arrows - A curve arrow sign is an official highway black on yellow sign before an intersection that shows where the main road goes through the intersection.

Protection - The main road is the single road leaving the intersection that has no stop or yield sign at that intersection. You need to recognize these signs possibly from the back side of the stop or yield signs.

Straight as Possible - The main road follows the road most directly ahead at the intersection.

Left (or Right) at T - The main road goes left (or right) at a T.

Left (or Right) at Y - The main road goes left (or right) at a Y.

Scoring:

There is always a description of how scoring is done. Typically in a TSD rally, the scoring is done by time off from perfect time. There are two things you should specifically look for.

1. What is the maximum score on each leg? This could be anything from 25 points to 100 points to 500 points.

2. What is the creeping penalty? The creeping penalty is provided to keep teams from driving extremely fast and then stopping in front of the control and going in at their perfect time. Two common definitions of creeping are stopping in sight of the control or going at ½ the CAST in sight of the control. In these situations, the general instructions will explain how the control crew will handle it. In a Monte Carlo rally, it is often given without any warning. On other rallies, if the crew feels you are creeping, you will be waved in, at which point you need to speed up to approximately the CAST in a timely manner.

Road Definitions:

While reading the generals, it is also important to check what roads exist on the rally. Typically this is a question of whether unpaved roads should be used on the rally or not. Some possibilities are that they always exist, they never exist, they exist only if they have a Stop or Yield sign controlling the traffic on the unpaved road at the intersection or they exist only in a route instruction includes the word "unpaved".

In addition, there is usually some information about whether "Dead End" or "No Outlet" roads should be used.

TA Information:

Teams should review the amount of TA that teams can take and how to take them. TAs are covered in much more detail in Section 11 of this material.

Timing:

There is usually information about timing in the GIs. This includes whether the rally is timed in seconds or hundredths of a minute. In addition, there is information about when you are timed at each control, usually when your front tires cross the timing line.

Glossary:

It is a good idea to review the Glossary to make sure that you understand the terms. This is especially true when you are running course rallies because this is a common place to hide traps.

Other topics that might be of interest include

Classes:

It is important to be aware of the classes in a rally. There are three common SCCA classes that we will focus on here.

Stock Class - This refers to a team that uses a standard odometer / speedometer unit that is not adjustable. In addition, the only computing equipment allowed is a 4-function calculator.

Limited Class - This class allows teams to use an odometer / speedometer unit that can be adjusted to match the rallymaster's mileages. Any computing equipment can be used, but the information from the odometer cannot be automatically included in this equipment.

Equipped Class - This class also allows adjustable odometer / speedometer, but in addition, the computing equipment can be fed information from the odometer directly. Teams in this class use a rally computer that handles all of the computations underlying the rally.

Almost all novices are in Stock class, which is the most difficult of the classes to score well in. However, the cost to perform in the higher two classes makes them prohibitive for teams that only rally several times each year. You should keep this in mind when comparing your scores with teams in other classes. A top team in Equipped class should get almost all 0 and 1 scores on each leg, a team in Limited class should get almost all 0, 1, or 2 scores on each leg. But a top Stock class might get scores as high as 5 on each leg. As such, stock scores will be higher in general even if teams have equivalent skill levels.

In addition, there are often other classes in our local events. These include an array of Historic classes for teams that bring historic cars out to the rally and frequently a novice class for teams that have not run many rallies (typically less than 10 or 20 between the two teams).

You should read through classes on the event flyer and if you are not sure which class you should participate in, talk with the registration staff on the day of the rally.

Safety:

A rally is not a race. There is often information about specific problems that you might face along the course. For example, there may be a definition that route instructions could include a

"Caution!" that explains problems along the route. Also, the GIs might alert teams to information throughout the route, such as frequent bicyclists or Amish wagons.

Course Measurement:

There is a section in most GIs that talk about where mileages given in the routes are taken. For example, mileages are taken at a Stop sign if present at the intersection, otherwise at the leading edge of the intersection. In general, this is not overly important for teams running stock because as long as the instruction can be executed within 1/10 of a mile of the mileage, teams should do it there.

Section 8: Examples of Route Instructions

Route instructions tell you how to drive around the rally route. Since rallies are scored on the basis of staying on-route and on-time, it is essential that you follow the prescribed route, since you can't be "on time" if you are "off route." The route instructions discussed here are intended to get you to the finish without off-route excursions. There are many different types of route instructions that you can see on a rally. In the end, they are easy to follow, and if you were to get these from a friend on how to get to their house, you would follow them without any problems or thinking twice about it.

Below are some common examples of route instructions that you will see in this region.

SCCA Format:

In most SCCA style events, route instructions are given in a 4-column format. The columns are described below:

1. Total mileage from the last point you zeroed your odometer to this NRI. This may or may not be given for a specific NRI (some events always give mileages, others give a few and still others give none).

2. Delta mileage distance between the start of the last NRI to the start of this NRI. This may or may not be given for a specific NRI. If all delta mileages were given, you could add each delta mileage to the total mileage to get the next total mileage value.

3. Numbered route instruction (NRI) number. Instructions are to be followed in ascending numerical order (i.e., 1, 2, 3, …)

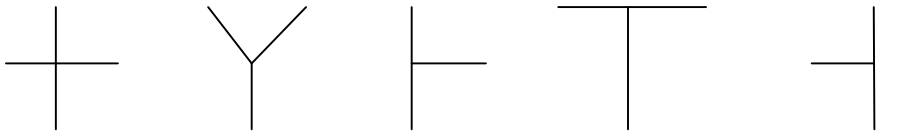
4. A written description of the next thing to do along the route. This could be a route directing action (Right at sideroad, Left on Jones Rd, Straight towards "Bridge Out Ahead"), something to see ("Roman Church", "Covered Bridge Ahead", Bridge), a new speed to maintain (CAST 25, CAST 35 at "Speed Limit 50"), a timing change (Pause 50, Pause 150 over next 1 mile), or anything else to help keep you on the route or get the correct timing.

An example of such instructions is below.

Mile	Delta	Inst. #	Instruction
0.00	0.00	1.	Begin Leg 1 at "Speed Limit 35". CAST 34.
1.07	1.07	2.	Right on Harbaugh Church Rd.
1.94		3.	Left at Stop (on Old Pen Mar). CAST 31.

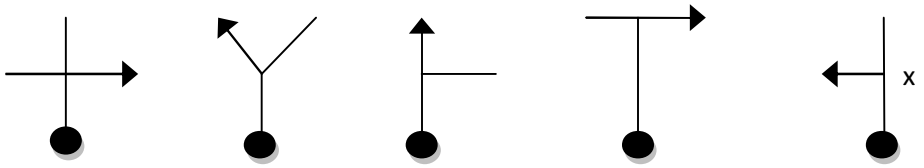
Tulip Diagrams:

The Tulip Rally in Holland was the first time this, now called Tulip, type of route instructions were used. A tulip is a stick figure drawing of an intersection as seen from above. Some examples of these pictures include:



Crossroad Y Right sideroad T Left sideroad

By simply adding a dot at the location where the rally route enters the intersection and an arrow where the rally route leaves, a route through each intersection is defined. The tulips are described below each picture, but these would not necessarily be given in the routes.



Right at Crossroad | Left at Y | Straight at Right sideroad | Right at T | Left at Left sideroad

By stringing a bunch of tulips together in order and you have a description of a rally route. In addition, additional information can be given in the tulip. For example, a sign may be given (i.e. "Smith Rd") marked by an x as to where the sign can be found in the intersection. An example of this is given in the rightmost tulip above.

There are some tulips that can be extremely complex and would require multiple instructions to get you through the intersection.

Clock Tulips:

Another variation of tulips is given by clock tulips. This is done by focusing solely on the road in which you enter and leave the intersection. Imagine arranging the hands of a clock to mirror the way through an intersection and combine that with the guideline "Enter by the minute hand;

leave by the hour hand". Using this format of instruction, there are numerous times which correspond to the same intersection. For example, the leftmost tulip above (Right at crossroad) could be given by 3:30, 6:45, 9:00, etc. The others could be given by 11:30, 12:30, 3:30, 9:30. Note that both a 90 degree right at crossroad or at a sideroad can be given by the same clock tulip. This highlights the fact that we only are focusing on the road that rally traffic enters and leaves the intersection **and no other roads**.

International Format:

The route instruction format most commonly used by the MG's of Baltimore is the International format, at this format combines the SCCA format with Tulip Diagrams. Each row of the grid is a line of data associated with the numbered route instruction (NRI) in the first column. The columns in this format are as follows:

1. Numbered route instruction (NRI) number.

2. Total mileage from the last point you zeroed your odometer to this NRI.

3. Delta mileage distance between the start of the last NRI to the start of this NRI.

4. Speed is the average speed (CAST) that you should begin traveling as soon as you execute the NRI.

5. Tulip consists of the tulip diagram for the intersection being travelled through in the NRI.

6. A comment column which gives additional information to help you follow the route or what to do regarding restart points or DIYC controls.

An example of this type of format (using the same instructions as in the SCCA format) is below.

NRI #	Total Mileage	Delta Mileage	Speed	Tulip	Comments and Information
1	0.00	0.00	34		Begin Leg 1 at "Speed Limit 35"
2	1.07	1.07			Harbaugh Church Rd
3	1.94	0.87	31		Old Pen Mar

Jogularity Sections:

In Europe, the increase in popularity of historic events caused the prices paid for old rally odometers and watches to increase dramatically. Soon, there was an argument of whether or not to allow modern digital equipment in historic cars.

Clever rally organizer John Brown sickened of the whole discussion and invented a new kind of rally instruction format which became known as Jogularity. The name comes from the event on which it first appeared: Le Jog.

The idea behind Jogularity is that the TSD calculations are already done for the competitor. A column is added to the route instructions (in the case of International format) for the elapsed time from the start of the section. Similarly, a Key time given this same information is added to the instruction (in SCCA format). The navigator starts his stopwatch at the start of the section and compares the watch readings with those posted in the route instructions. The crew drives to those times with the navigator informing the driver as to whether the is running ahead or behind at each instruction.

Jogularity instructions are great for beginners because it is excellent training for the navigator to help the driver stay on time without having to learn about all the details of calculation. It is also good for events where there are other challenges besides staying on time.

Maps:

Obviously maps can be used in numerous ways to give route information. Some examples of ways that maps can be used to plot a route are below.

1. A route can be defined by giving a start location, a sequence of route numbers and road names to be followed until the finish is reached.

2. A path can be traced from the master map onto a transparency that can be given to each team. The team then needs to find the one place on the map where the transparency matches up with roads on the map which gives the course. In the easiest case, the transparency can just match up with the edge of the map to determine the route.

3. A map can be given to contestants with the route defined by a dark pen or highlighter that defines the route.

4. In British rallies, an entire rally can be given on a single sheet of paper that contains a sequential list of map references to be followed. For more on this type of rallying, check out the Table Top Rallying webpage at (www.table-top-rallying.org.uk). For details on how to plot map references, check out Appendix D.

Section 9: The Odometer Calibration Leg (a gentle beginning to the rally)

As you have seen, the start of a Rally tends to be a pretty busy time and place. The actual rally, fortunately, begins with a Odometer Calibration Leg, which is a straight-forward set of instructions that will allow you to compare your odometer to that of the rallymaster. There are no checkpoints on this part of the rally and no average speed to maintain, as such the only thing you need to do is stay on course.

Most rallies tell you that the rally is self starting. That means that as soon as you are happy that you have the routes, have set your clock to official time, and have filled out all the necessary paperwork, then you can start your rally. This is useful because as you get better, you will have more to do at the end of the odometer calibration leg and this additional time will be useful.

Why do we need to calibrate our odometer?

Because no two odometers are exactly alike! As such, the rallymaster's odometer is different than yours. Since odometers tend to be gear driven, the differences between your mileage and the rallymaster will become larger the farther you travel. This can affect you negatively in two ways:

1. There may be an instruction to turn at a specific mileage which you cannot do easily unless you can correct your mileage to match that of the rallymaster.

2. If you are keeping time based on a method tied to the formula Time = Distance / Speed, then your time will be wrong because your distance is wrong.

On your first several rallies:

As you start rallying, you should focus solely on whether your odometer reads longer or shorter than the rallymaster's mileage. At the start of the Odometer Calibration Leg (OCL), zero your trip odometer and follow the route. If the official mileage is 10.0 at the end of the OCL, and your odometer reads 10.4 miles, then your odometer reads long. This tells you that if you are given a route instruction at 34.3 miles, then you will likely be well beyond that point when you reach that instruction. In addition, you will likely need to drive slightly faster than CAST to account for the difference in mileage.

The next step might be to think about how much you are long (in general terms). In the example above, you are reading about 0.4 miles long every 10 miles. So you would expect you would be about 1.2 miles long after 30 miles. So the route instruction at 34.3 official miles will likely come up around 35.5 miles. You can even refine this more by saying you are halfway to 40 miles, so it will likely come up just before 35.7 miles (adding another 0.2 miles). As you can see, if you think you will be reaching the instruction at 34.3 miles, you would be very concerned when you don't see the instruction for almost 1.5 more miles! That is why you need to be aware

of odometer calibration.

Using basic math to correct your odometer:

When you get to the end of Odometer Calibration check, write down your mileage so that you can calculate with it. Typically, you rezero at the end of the OCL (but you should make sure it says to do that in the Routes or the General Instructions). Then move your car ahead and off the road so that other teams can get the Calibration point and do the same things you will be doing.

Let's use our same example where the official mileage is 10.0 miles and your trip odometer registers 10.4. The formula for your odometer calibration factor (OCF) is given by:

OCF = your odometer mileage / official mileage

In this example, OCF = 10.4 / 10.0 = 1.04. This says that your mileage is 4% higher than the rallymasters's mileage, and it will likely stay at this level for the entire rally.

Since you know this factor, you can modify the mileages given in the routes as well as the speeds at which you should drive. These two formulas are given as:

Your corrected mileage = official mileage * OCF

Corrected CAST = Official CAST * OCF.

Using the distance formula, if an instruction requires you to turn at 23.5 miles, you should be making that turn at 23.5 * 1.04 = 24.44 miles (almost a mile further down the road from where you would be expecting the turn if you didn't correct your mileages).

Similarly, if you were given a CAST of 42 mph, you will need to drive at 42 * 1.04 = 43.7 mph. This is sometimes called a corrected average speed. This modification to CAST is important because if you didn't correct the speed in this example, after 5 miles, you would be almost 17 seconds or 0.28 minutes late!

If your mileage is less than the official odometer during the Odometer Calibration Leg, then your mileages will be shorter than official mileages and you will need to drive slower than CAST (which is taken into account in the above formulas).

Section 10: Basics of Timekeeping

As you enter the sport of rallying, the most important thing is to find the rally route, get comfortable with controls and what you need to do there, and reach the finish so that you can have food & drinks with your competitors. Probably the last of these is most important!! However, once you have run several rallies, you may want to do more than just drive around the course. Specifically, you may want to try to add timekeeping to your skill set. There are SO many different types of timekeeping that everyone can find one that they want to try. We will try to summarize a number of these timekeeping methods here along with references for them (as appropriate).

The CAST + 2 method:

This is the most basic form of timekeeping and is often called Seat of the Pants (SOP) Navigation. When you are out on the course, you leave the start of each leg at the time that you should, but whenever it is safe to do so, you should drive at 2 MPH higher than the given CAST. This will make up for places where you need to slow down or stop (sharp bends in the road or at intersections). If you need to do any pauses along the route, you should find a safe place to pull off the road and follow your timepiece to wait out that time, and then start going at CAST + 2 again.

As you get more comfortable with this method, you should also try to get a sense of what is happening along the rally route. For example, if you are on a straightaway for most of the leg, then by going CAST + 2, you are likely early and you might slow down a bit prior to the control. Similarly, if you are reaching lots of intersections and are below speed frequently, you should drive faster than CAST + 2.

As you run events, try to get a sense of whether you are consistently early or late. If you are always very early or very late, you should modify this rule to get closer to being on time more consistently. This is why it is important to look at your scoresheets and think about this while you are running the rally.

Advanced SOP Navigation:

As you get better with Basic SOP Navigation, teams then have a decision to make. Do you move into some form of odometer based timekeeping or do you make further improvements to your SOP Navigation skills? We will talk about odometer based timekeeping later in this section, but a downside to those methods is finding a navigator becomes more difficult because the skills are

pretty specialized. Such a navigator needs to have great organizational ability, coolness and grace under pressure, being more competitive and requiring a fair bit of mathematical ability.

As such, if you decide to further improve your SOP skills, what will likely evolve is a team with a series of independent tricks for staying on time. These tricks are applied as needed, and otherwise staying on time is left to the skill of the driver. For the remainder of this section, we outline some of these tricks.

1. The driver must practice keeping to an average speed. As described in other places in these course materials, they should write their own rally and practice making the times for various legs. The goal of these efforts is to develop the innate sense of being "on time" as well as understanding if you are early or late. This skill is fundamental for the driver to hone if teams will continue improving in SOP navigation.

If possible, you should write your own little rally of about 5 miles with no stop signs. Measure the course and assign various (safe!) average speeds to it and calculate the ideal time to drive the course. (Note: you can get help from various area experts with these tasks, just ask us for help!). Have the driver try it with the navigator reading off the instructions and average speeds. Run it over and over again until you are satisfied the driver is doing a reasonable job.

Once the driver can be relied on to maintain an average speed, then the bag of tricks boils down to developing countermeasures for those situations where the driver is forced to deviate from the average speed.

2. At any restart point, such as leaving the odometer check, the team is behind schedule by the number of seconds needed to reach the average speed. By starting before the outmarker so that you can cross that line at the proper time **already** at the required speed, it is no longer necessary for the driver to compensate by going faster. It should be noted that to do this correctly, you need to understand how your car accelerates when driven normally and in rally driving.

3. Since Stop and Yield signs represent major deviations from the average speed, an advanced SOP team will be braking later and accelerating harder so they have less to make up for. Learning what these deviations do to your timing is fundamental to getting good scores more regularly. One way of doing this is to put a "Stop" into your 5 mile rally from above. Come to a stop and get back up to speed. Then run the remainder of the course on CAST and see how much later you are. This will likely surprise you, because you will be much later than expected. Now that you understand how late you are, run the course again (keeping the "Stop" in your rally) and try to compensate for it. Continue running the route until you can make up for this deviation effectively.

As you continue running rallies, you will find more situations which require deviations from average speed. Try to work out a compensation technique to account for these situations, which usually involve little or no mathematics. This requires practice to get good at these various tricks that the team develops.

Compensation Method:

This is another method of advanced SOP navigation, which includes more tricks that you can add to the bag of tricks collected in the previous method. We already assume the driver can do a reasonable job of following the average speed as long as his rhythm isn't interrupted. This method focuses on major deviations from the average speed, such as stopping at a stop sign.

In this method, you need a time of day clock that you have set to the official time and a separate stopwatch to measure these delays and to time the duration of the compensating speed. This is also the first method where the navigator might want to keep a log for each leg of the rally to keep track of the math (although the math is simple and minimal).

When rallying using SOP navigation, the driver is expected to keep to the average speed. This means he is expected to speed up occasionally in response to small delays. If big deviations in the average speed are encountered, however, at places like stop signs and very slow turns, then even experienced drivers lose the "feel" for how much faster to go for what distance to compensate for the delay. This method is intended to correct these gross deviations, allowing you to get back on time when you are forced to deviate from CAST by an abnormal amount.

<u>Procedure:</u>

1. As you approach the yield or stop sign, you will begin to slow down. When you reach ½ of the CAST you should be maintaining, the navigator should start the stopwatch. After you get through the intersection and begin accelerating again, the navigator should stop the stopwatch when you again pass ½ of the CAST.

2. On your timing log, record your CAST and the number of seconds (hundredths) elapsed for the maneuver, which you can read from the stopwatch.

3. Divide your CAST by 10 and multiple by the number of seconds (hundredths) that you are late.

4. The answer is the number of seconds (hundredths) that the driver must run at (CAST + 10%) MPH to make up the time. The navigator needs to inform the driver of this new speed. As the driver speeds up, the navigator again starts the stopwatch (after zeroing the elapsed time). When

the time to drive CAST + 10% is completed (determined by looking at the stopwatch), the navigator tells the driver to revert to the original CAST.

5. If CAST + 10% is too fast for the road conditions, you can have the driver go at CAST + 5%, and double the number of seconds (hundredths) to go at that new speed.

6. If there isn't enough distance between maneuvers to make up all the time, simply carry the number of seconds not yet made up forward to the next opportunity to make up time. The navigator needs to be aware of this time if they suddenly reach a control, at which point the driver should get to the control as quickly as possible to make up as much of that time as possible.

This procedure is a gentle method of making up time. At 10% over the CAST, one second of lateness is made up for every 10 seconds of driving at CAST + 10%. It is a good way of compensating for a big deviation in average speed that occurs over a short period of time. However, if these big deviations occur over a long period of time, such as pulling over at the side of the road for a minute to resolve a route question, a make up rate of 1 in 10 is not adequate, because you will almost certainly reach a checkpoint before the time is completely made up.

In this case, speeds greater than CAST + 10% are required. The tables on the next page show you the number of seconds or hundredths and higher speeds that are required to make up specific numbers of seconds of delay. Which speed you select to go is a matter of law and common sense. The first column of the first two tables is the length of the delay you have measured with your stopwatch in seconds (hundredths). Subsequent columns give the number of seconds (hundredths) you must travel at speeds plus the percentage given at the top of the column.

Remember that **SAFETY COMES FIRST** on a rally! Most events have checkpoints every 10 to 20 minutes apart, so there are clearly some delays that cannot be made up even in a Formula One Ferrari! Be legal, be safe, and be sensible. By trying to make up for a big delay by high speed driving, one risks irritating the locals along the rally route, attracting police attention, or having an accident. It isn't worth it! In cases of having a major delay along the route, you should use a Time Allowance (see Section 11) to get yourself back "on time". It is far better to take a few penalty points than to bring the sport to ill repute or put yourself and others at risk by driving too fast.

Time Necessary to make up for a Deficit by means of Increasing CAST by a Percentage

(Times within the table are given in Seconds)

Time Lost (in seconds)	CAST + 10%	CAST + 20%	CAST + 25%	CAST + 33.33%	CAST + 50%
5	50	25	20	15	10
10	100	50	40	30	20
15	150	75	60	45	30
20	200	100	80	60	40
25	250	125	100	75	50
30	300	150	120	90	60
60	600	300	240	180	120

Time Necessary to make up for a Deficit by means of Increasing CAST by a Percentage

(Times within the table are given in Hundredths of a Minute)

Time Lost (hundredths)	CAST + 10%	CAST + 20%	CAST + 25%	CAST + 33.33%	CAST + 50%
10	100	50	40	30	20
20	200	100	80	60	40
30	300	150	120	90	60
40	400	200	160	120	80
50	500	250	200	150	100
100	1000	500	400	300	200

CAST incremented by these percentages

(Values within the table are the new CAST with the appropriate percentage added)

CAST	CAST + 10%	CAST + 20%	CAST + 25%	CAST + 33.33%	CAST + 50%
20	22	24	25	26.66	30
25	27.5	30	31.25	33.325	37.5
30	33	36	37.5	40	45
31	34.1	37.2	38.75	41.333	46.5
32	35.2	38.4	40	42.666	48
33	36.3	39.6	41.25	44	49.5
34	37.4	40.8	42.5	45.333	51
35	38.5	42	43.75	46.666	52.5
36	39.6	43.2	45	48	54
37	40.7	44.4	46.25	49.333	55.5
38	41.8	45.6	47.5	50.666	57
39	42.9	46.8	48.75	52	58.5
40	44	48	50	53.333	60
45	49.5	54	56.25	60	67.5

The remaining SOP document in this package is relatively extensive and was written by Elliott Woodward who was an SCCA Champion back in 1975. This can be found in Appendix F, along with an addition by Jeanne English, a top current SCCA National competitor.

Odometer Based Computation Methods:

The remaining timing information focuses on how to use your odometer information to help the navigator compute the perfect time at places along the course. This section requires a great deal of mathematics and use of the formulas in Appendix B. The navigator will need to be computing relatively often throughout the event and keep track of information in log tables for each leg. However, once you have practiced this method for a while, it becomes second nature and can further decrease your average scores on each leg.

We go through several examples of how to do these calculations in the next section. For beginners to computations, we would recommend that you compute your perfect time at each instruction. At each turn, the driver should call out the mileage and the navigator should look at the clock to get the time. Then the driver can give the navigator exactly how far up or down the team is, but this will usually be several seconds after the turn, the time it takes to calculate the perfect time after the turn. Then, the driver can drive SOP between instructions.

As teams continue to get more comfortable with the odometer based calculation methods, they will want to give information to the driver more frequently. One way this can be done is the EZ Rally Timing Method by Gary Starr, which is included in Appendix G.

Calculating Perfect Times:

We go through the mathematics tied to these calculations in this section. We will look at this example twice, once completely with a perfect odometer calibration factor (OCF) of 1, and once to show some details about how to handle a different odometer calibration factor.

You are Car #12 in this rally, and you have just reached the end of the Odometer Calibration Run. Your car's odometer reads 10.62, so you have a perfect OCF of 1. The five route instructions we will consider are given on the next page.

NRI #	Mileage	Delta	Notes	Instruction
12	10.62/0.00	0.22	ETZ CAST 34	End Odometer leg at "Mile 14." Zero Odometer. Start Section 1. **Key Time: 2:15.00**
13	0.96	0.96	CAST 30	Right at "Ferncliff"
14	1.41	0.45	CAST 44	Right at Traffic Light. Pause 50
15			CAST 20	Left at first sideroad. Pause 15. Becomes gravel.
16	2.22	0.62	CAST 32	Stop.

In many rallies, not all mileages will be given. In this sample rally, there are no mileages given for NRI 15, for example. However, if you are given delta mileages after that, you can compute these missing mileages.

Question 1: What was the official mileage at NRI #11?

Question 2: What is the official mileage at NRI #15?

Question 3: What is the delta mileage for NRI #15?

Question 4: What is our out time / start time for the leg that starts at NRI #12?

Question 5: What do we do at NRI 16? (not a timing question)

As described in the section on odometer based computation methods, the first step in doing these computations is to calculate the perfect time at every instruction and give the driver a sense of how far up or down they are in time. We consider this method using the following leg calculation log.

NRI	Our	Official	Delta	Official	Perfect	Perfect	Our	

	Mileage	Mileage	Mileage	CAST	Interval Time	Accumulated Time	Clock	+ / -
12	10.62	10.62	0.22	None		2:27.00		
13		0.96	0.96	34				
14		1.41	0.45	30				
15				44				
16		2.22	0.62	20				

When we get to NRI 13 and make the right, we check our mileage and make sure we are still tracking with the official mileage. The navigator looks at his timepiece and writes down the time the team arrives there (let's assume it was at 2:28.83). The navigator then uses the formula that **Time = Distance * 60 / Speed**. In this case, Time = 0.96 * 60 / 34 = 1.694, which is the perfect interval time. You add that to the previous perfect accumulated time to get the new time. Then we compare that to the clock we looked at above to get the + / - column. Our log now looks like the one at the top of the next page.

NRI	Our Mileage	Official Mileage	Delta Mileage	Official CAST	Perfect Interval Time	Perfect Accumulated Time	Our Clock	+ / -
12	10.62	10.62	0.22	None		2:27.00		
13	0.96	0.96	0.96	34	1.694	2:28.69	2:28.83	14L
14		1.41	0.45	30				
15				44				
16		2.22	0.62	20				

This shows that we were 14 late at NRI 13, so we would tell the driver to speed up, as he is 14 late.

Question 6: Fill in the rest of the table below in this same manner (we have added the mileage we were at and what our clock read at each instruction).

NRI	Our Mileage	Official Mileage	Delta Mileage	Official CAST	Perfect Interval Time	Perfect Accumulated Time	Our Clock	+ / -
12	10.62	10.62	0.22	None	----	2:27.00	---	---
13	0.96	0.96	0.96	34	1.694	2:28.69	2:28.83	14L
14	1.41	1.41	0.45	30			2:29.34	
15	1.60			44			2:29.68	
16	2.22	2.22	0.62	20			2:31.75	

Now that we have done the example once, what happens if we had a different mileage from the official mileage at the end of the odometer calibration leg? Let's assume that our mileage at the end of the odo leg was 10.43 miles. You compute the odometer calibration factor by Our Mileage divided by the Official Mileage.

OCF = 10.43 / 10.62 = 0.9821.

In this case, we can tell what the official mileages are throughout this part of the rally so we will use those official mileages to compute the perfect times (because that is what the rallymaster used!), but we should still compute what our adjusted mileages should be so we know where to make the turns. In fact, because you know all the mileages, you could do these same computations prior to starting the rally and simply making sure you are on time at each instruction.

Let's consider what mileage we expect to see on our car's odometer at NRI #13. You compute the official mileage * OCF to get our mileage. In this case, 0.96 * 0.9821 = 0.943 miles.

Question 7: Compute our expected mileage at each of NRI #14, 15, and 16 with this OCF.

Finally, we consider what happens if you don't have all the mileages. Consider the log table below. At the end of the odometer leg, our mileage is 10.96.

Question 8: What is our Odometer Calibration Factor in this case?

We then take our mileage at NRI #13 and compute the official mileage by taking our mileage and dividing by the OCF. This gives us an official mileage of 1.046. We then compute the delta mileage using this calculated official mileage (giving us 1.046). Then you can compute the perfect interval time (just as before), which in this case is 1.846 minutes.

Question 9: Continue these calculations to fully fill in the log table below.

NRI	Our Mileage	Official Mileage	Delta Mileage	Official CAST	Perfect Interval Time	Perfect Accumulated Time	Our Clock	+ / -
12	10.96	10.62	0.22	None	----	2:27.00	---	---
13	1.08			34			2:28.83	
14	1.64			30			2:29.84	
15	1.94			44			2:30.48	
16	2.35			20			2:31.55	

Answers to Questions in this Section

Question 1: 10.40 miles

Question 2: 1.60 miles

Question 3: 0.19 miles

Question 4: 2:27.00

Question 5: Stop at the stop sign and change CAST to 32 mph

Question 6:

NRI	Our Mileage	Official Mileage	Delta Mileage	Official CAST	Perfect Interval Time	Perfect Accumulated Time	Our Clock	+ / -
12	10.62	10.62	0.22	None	----	2:27.00	---	---
13	0.96	0.96	0.96	34	1.694	2:28.69	2:28.83	14L
14	1.41	1.41	0.45	30	0.90	2:29.59	2:29.34	25E
15	1.60	1.60	0.19	44	0.259	2:29.85	2:29.68	17E
16	2.22	2.22	0.62	20	1.86	2:31.71	2:31.75	4L

Question 7: NRI 14: 1.385 miles

NRI 15: 1.571 miles

NRI 16: 2.180 miles

Question 8: Odometer Calibration Factor = 1.032 (= 10.96 / 10.62)

Question 9:

NRI	Our Mileage	Official Mileage	Delta Mileage	Official CAST	Perfect Interval Time	Perfect Accumulated Time	Our Clock	+ / -
12	10.96	10.62	0.22	None	----	2:27.00	---	---
13	1.08	1.046	1.046	34	1.846	2:28.84	2:28.83	1E
14	1.64	1.589	0.543	30	1.086	2:29.93	2:29.84	9E
15	1.94	1.880	0.291	44	0.397	2:30.33	2:30.48	15L
16	2.35	2.277	0.397	20	1.191	2:31.52	2:31.55	3L

Section 11: How to Calculate Time Allowances

The goal of this section is to explain what Time Allowances (TAs) are and how to use them successfully in various types of rallies. By learning how to effectively use TAs, you can make the sport of rallying much more enjoyable and safe for everyone. Unfortunately, this is one of the least well understood aspects of the sport, and we hope this will provide a concise explanation of the concept.

What are TAs?

We begin by answering the question "What are TAs?" The basic idea of a TA is to give rally teams a way of getting back on time after a significant delay, without requiring competitors to speed or drive recklessly. What do we mean by "significant delay?" Basically, things that cause you to become more than 30 seconds delayed. Some common examples are: encountering a train at a railroad crossing, arriving at a place where cows are crossing the road, and arriving at the scene of an accident. Not all reasons for TAs need to be independent of the competitor. If you get lost, and then find your way back onto the course, that is a perfectly fine reason to take a TA. Also, if you have mechanical troubles, flat tires, etc, you can take a TA if you can fix it in a timely manner.

Historically, TAs were not always present in RoadRallying. There were many examples of competitors getting lost (for example, driving down the wrong road for a minute), and then driving at greatly unsafe speeds (sometimes in excess of 100 mph) to get back on time. There were other examples of teams getting "caught" by a train at a railroad crossing, and because they couldn't make up the time ended up losing the rally. This was an original source of the phrase "rally luck!" In our current day and age, driving recklessly is unacceptable and strongly discouraged by those who love the sport and want to see it continue. Thus, TAs were introduced to allow teams to get back "on time" without having to drive recklessly.

How do TAs work?

The idea behind a TA is that you can "add" time to the perfect time for the leg. So if you are stuck at a Traffic Light for 1.50 minutes, and you are only given a 1.00 minute pause, then you are suddenly 0.50 minutes (30 seconds) late. Therefore, before the control, you will need to make up those 30 seconds. Unfortunately, if you think you are close to the control, then the control could be right around the corner (and thus, you wouldn't be able to make up the time). In this circumstance, you should take a TA (here, one of 0.50 minutes). Let's work through an example of what happens when you arrive at the control. Assume the leg was supposed to take 12.42 minutes and you arrive with a total leg time of 12.95 minutes. Then you score would be a 53 (12.95 - 12.42) if you didn't take a TA. But, if you bought 0.50 minutes with a TA, then you can imagine adding this time to the perfect time, getting a modified perfect time of 12.92 minutes. You can then determine your score as normal and now you would get a 3 (12.95 -

12.92). As you can see, by buying time, you can safely get a good score, even if you end up being delayed.

Why do TAs always have to end with .50?

This is a common requirement for TAs, which we will go into more here. In a perfect Rally, everyone would be exactly "on time, all the time". From an aerial view, you would see cars exactly one minute apart at all times. This is especially true when you see teams coming into controls. When you think about taking a TA, what is happening is that we are taking one of those cars and moving it further back in the field. The reason to require TAs to be taken ending in .50 minutes is that when you move back, you will move exactly between two cars further back in the field. This makes entering controls much safer than allowing random TA values.

Imagine if instead you took a TA of 3.00 minutes (and let's say you are car #3). Then your new perfect time would be exactly the same as Car #6's perfect time. As you come into the control, both teams would want to reach the timing line at exactly the same time, which would be incredibly unsafe. In almost all cases, you should take a TA whose total ends in 0.50 minutes (i.e., 0.50, 1.50, 2.50, ..., 19.50 minutes), so you will end up exactly between two later cars.

Taking TAs

One thing to keep in mind when you are taking TAs, especially the first few rallies in which you actually take a TA, is that it is almost always a good idea to take an extra minute from what you think you need. What do we mean by that? Think about the scenarios where you take a TA. You have gotten stuck behind a train, gotten lost (and recovered), had a mechanical problem, etc. In these situations, you usually have a higher stress level than you want when running the rally. At this point, you need to calculate how long a TA you will need to take. Once you have that number and you know when you would need to leave your current location, add another minute to your TA (and subsequent time to leave that point). In that minute, take a deep breath and get back into your mindset for how you will stay on time (no matter which method you are using).

When you are taking a TA, there is usually a form to write down your TA and car number. This varies depending on the rally, but it is usually on a scorecard or on a separate TA form. It is a good idea to write down the amount of the TA that you are taking so that you don't forget the amount when you arrive at the control. This sounds simple, but people have been on rallies where the TA they were taking changed from 7.50 minutes to 8.50 minutes due to another team being "on our minute". Unfortunately, the TA didn't get written down, and so on the form, the 7.50 minutes was bought. This resulted in a perfect 100 late, instead of the 0 we thought we got. Similarly, if you need to hand in a special form, it is a good idea to have a plan to remember to hand that form in at the open control (since a lot is going on at controls, and it can be easy to forget this item since you hopefully don't do it as a regular part of your control drill).

It's important for you to know how long is a TA is good for, in other words, when do TAs reset.

In open control rallies, TAs are usually only good for the leg they are taken on (as a new out time is given at a control, which the crew will be on time for). In closed control rallies, TAs are usually good for an entire section (until a key time, or when you turn in your TA form). This will be described in the GIs for the event. You need to make sure you find this information in each event's GIs and understand it before starting on the rally.

To conclude this section, we discuss things that you should look for in an event's GIs related to Time Allowances, in addition to how long a TA is good for.

1. **What is the cost for taking a TA?** Some rallies in the past "charged" for a TA, frequently doubling your score. Almost all rallies today have "free" TA.

2. **What are the limitations on taking TAs (i.e., always ending in .50 minutes)?** Some events require the minimum TA to be 1.50 minutes.

3. **When do TAs reset and what is the maximum amount of TA that you can take?** Most events limit cumulative TA taken to 19.50 minutes for the event. This is done to allow control crews to leave their control location in a timely manner (to make it to their next control prior to the first car's arrival).

4. **Where do I turn in TA forms?** Sometimes a rally will use "automatic TAs". In that case, the organizers will simply give you an assumed TA during scoring to result in the best score for the contestant. While this is less paperwork for the navigator, it is still important to go through the procedure and take the correct TA in the car to get a good score. Otherwise, you will likely end up with a random score, which is not what you want to do.

We now conclude this section by explaining some methods of taking TAs depending upon the timekeeping method being used and/or the type of rally.

Taking TAs on a Monte Carlo Rally

The simplest example to show how to take TAs is on a Monte Carlo rally. In a Monte Carlo rally, the perfect time for Car #0 is given in the route instructions. For example, if NRI 44 is Control #4. 8.43 Miles. Key Time: 3:43.35.

Using the jumping off method of running a Monte Carlo rally means you get to the point 0.50 miles before the control (in this case 7.93 miles) and drive 30 mph for 1 minute to get into the control exactly on time. To get your arrival time in this type of rally, you add your car number to the Key Time, and that gives you your perfect arrival time.

Consider for this example that you are Car #7. In the method above, the perfect arrival time for Control #4 is 3:50.35. Assume you get to the jumping off point (at 7.93 miles) at 3:52.79, so

you have clearly missed your time to leave. Without taking a TA, you are guaranteed a maximum score (as you cannot arrive at the control on time, or even 2 minutes late anymore!). You need to take a TA here, what do you do?

In a Monte Carlo event, since you know the perfect arrival time, you can consider what taking various TAs mean. Since you need to take a TA that ends in 0.50, possible new arrival times are shown in the following table:

TA Amount	New Perfect Arrival Time
0.50	3:50.85
1.50	3:51.85
2.50	3:52.85
3.50	3:53.85
4.50	3:54.85

You also know that it will take you 1 minute to get to the control from the jump off point. If you left right now, you would get to the control at 3:53.79. To determine what TA amount you should take, find the first perfect arrival time that is greater than 3:53.79. That is a 3.50 minute TA, with arrival time of 3:53.85. Thus, you need to leave the jump off point just 0.06 minutes after you started thinking about this. As such, you probably want to take another minute so you have more time to get your mind back on entering Control #4. Thus, if you took at 4.50 minute TA, you will arrive at 3:54.85 and will need to leave the jump off point at 3:53.85.

Taking TAs on a TSD Rally using a Calculation Method

If you are doing a calculation method, either with a computer or the EZ Calculation method with a calculator, taking TAs is not hard. When you get lost or delayed for some reason, you can compute the correct time that you should be at the given point (in the calculation method, you might be able to compute the time at the next 0.1 mile or the next intersection if all mileages are given). At that point, you know exactly what time you should be at that point on the course (using the calculation). You can then look at the clock to determine the difference.

We consider an example of this. Assume you got stopped at a railroad crossing due to a train. When you get to the next 0.1 mile or next known instruction, you stop the car (when you get better at this, the navigator will be able to do this on the fly, but initially, it will help the navigator to stop). Have the navigator calculate what time you should be at that point. In our

example, it is 4:32.24. Look at the clock to see the current time (assume 4:35.50). Take the difference (4:35.50 - 4:32.24 = 3.26). You should take a TA (which for a TSD rally corresponds to simply taking an unscheduled pause) for either 3.50 minutes (or 4.50 minutes if you want time to compose yourself). Assuming you bought 4.50 minutes, that means you should leave at 4:32.24 + 4.50 = 4:36.76 and you should add this 4.50 minutes in as a pause into your calculations. Because this is hidden in your remaining calculations, make sure you write down this amount when you add it in!

Taking TAs on a TSD Rally using a Seat Of the Pants (SOP) Method

This is the hardest case of coming up with an exact value for which to take a TA. In general, the method for taking a TA is determining how much time was lost due to a problem on the rally course and then waiting until you are some x.50 minutes later before starting up again. We break this method down into two separate cases: a slowdown on course and an off course excursion. For both methods, we assume you have a digital stopwatch with you.

First, we consider the case where you are slowed down on course, for instance due to encountering an accident. In this case, when you see the slowdown coming up, start your stopwatch when you reach ½ the CAST you are supposed to be traveling. After the slowdown is over, stop the stopwatch when you have accelerated back up to ½ the CAST. That gives you an approximate pause. If it is close to a x.50 minute pause, continue on at the given CAST. If you are early or late, you may need to speed up or slow down for a period of time to get the delay to an even x.50 minute pause. This is then the amount of the TA you should take.

We now consider how to determine the TA when you get lost. This is more difficult in SOP than just about any other thing. We will still use the stopwatch in this case. The difficulty comes because you don't realize you are off course until you reach the point where you realize you have to turn around. When you start turning around, start your stopwatch. Now comes the difficult part! Drive back to the point where you are back on course **at the same speed as you drove when you are going off course**!!! This is very difficult because your natural inclination at that point is to race back to the course to minimize your time off course. If you do that, however, you will lose the ability to determine what TA to take.

When you reach the point where you rejoin the course, stop the stopwatch. This will give you the time it took you to get back on course. You must **double** this time, as it should be about the same time it took you to get to the turnaround point. If your stopwatch reads 3.42 minutes, your total off course excursion was approximately 6.84 minutes. You then can either try to make up the 0.34 minutes and take a 6.50 minute TA or take an additional 0.66 minutes of pause to result in a 7.50 minute TA.

Alternative SOP method for taking TAs

A slightly more sophisticated method of taking TAs for a SOP crew requires more work from the

navigator. In this method, the navigator needs to write down the time the crew arrives at each route instruction (or at other landmarks along the course if there is a long stretch between route instructions). Then, if you get lost, it is simply a matter of returning to the last point where you were known to be on course for which they have written down a time. Since the navigator knows the current time at that point, the team knows exactly how long they have been off course. They can use exactly the same method as given in the calculation method for computing the TA.

The downside to this method is that you may need to drive further back if you do not have the time at the place where you went off course. The upside is that you do not need to drive slowly back to the place you went off course. This is a great method for teams that have rallied for a while, but don't want to calculate. It is a small step for the navigator to learn in terms of complexity, but is very useful when a TA is required.

Section 12: Rules of Etiquette / Items for Novices

There are a number of basic things that we want to focus on prior to your first rally. These items will also be helpful as you get more familiar with the sport.

1. Stay in your minute! Many novice rally crews decide to focus solely on following the route and ignoring timing. This is a mistake for a variety of reasons:

* On events suitable for a novice crew, the instructions are usually easy to follow, so there is no need to focus on them to the exclusion of time, especially given the basic "2 MPH over CAST" timing method.

* Some crews "get in a rut" and drive the events without ever improving and grow frustrated with the sport.

* In extreme cases, teams are driving 10-20 minutes prior to the Car 0 time because they just want to see the scenery. This results in a team that may miss many controls because they aren't set up when they go by. In this case, control crews get confused because a team doesn't arrive and this can cause problems to occur with these crews at future controls.

* On most rallies, the cars start 1 minute apart. Each car is moving along in a moving window of 1 minute's duration. A good crew tries to stay on time in the middle of that window. A team not paying at least some attention to time can suddenly be caught from behind by a crew that is trying to stay on time, or they can catch a crew ahead if the novice is traveling well above the current CAST. In both cases, the casual crew will interfere with the team diligently trying to stay on time. So it is good rally manners to stay in your minute.

Since most rally legs are 5 to 10 miles in length, if you honor the key time to start the leg and make a reasonable attempt to drive the CAST, your score at the end of the leg shouldn't be too bad. If you pay no attention to time or speed, you will have a poor score and might cause someone else to lose points in the bargain.

2. Another problem with people paying no attention to time is that rally cars can cluster into groups. If 5 cars are running together, then at least 4 of them are in the wrong minute. They will all arrive at a checkpoint together and fluster the checkpoint crew, who are expecting cars 1 minute apart. This is a trap that teams fall into when they feel that they can't follow the route instructions. This is why events that are appropriate for novices are written so that everyone should be able to get through the event and make it to the party at the finish. Please try to avoid forming a convoy with other competitors. This can also happen when multiple cars take a TA. If Car #3 is on a 1.50 minute TA and Car #4 is on a 0.50 minute TA, then they will be fighting for the same perfect time. Once this becomes obvious, the trailing car should take an additional minute of TA to alleviate the situation.

3. It is important to be aware of your surroundings. If you are rallying along and suddenly a car comes up behind you very quickly, try to get off to the side and let them go by. This often happens if someone misses a speed change or if someone isn't paying attention to time. The worst thing you can do is try to block the road because it will often cause them to make crazy moves in an attempt to get by you. The same is true if you are suddenly coming up on a local or another competitor. Try to be nice when going around them at the next safe opportunity. It is for cases like this why Time Allowances were introduced.

Appendix A: Glossary of RoadRally Terms

Note: All the terms in this glossary represent standard definitions. Definitions given in any General Instructions would take precedence over these!

Acute – Turn in the indicated direction from 100° to 179°.

At - "In the vicinity of" for actions that direct a course of travel; "even with" for other actions, including speed changes, mileage, pauses, etc.

Bear – Turn in the indicated direction from 10° to 80°.

Before - In sight of and prior to the referenced navigational aid.

Blinker - A warning signal at an intersection or railroad crossing which the contestant is obliged to obey. The blinker consists of a light or lights, usually red or yellow, operating in a fixed sequence of on and off. For rally purposes, only one blinker may exist at an intersection or railroad crossing. The blinker may or may not be operating.

CAST - Change, continue, or commence average speed to.

Control - The timing line of an open or passage control as identified by a checkpoint sign or an observation control as identified by an OBS sign, or a DIYC as identified in an instruction.

Crossroad - An intersection of exactly four roads from which a road goes to the left, a road goes to the right, and a road goes generally ahead.

DIYC - Do-It-Yourself Control

Free Zone - A specified part of the timed rally route in which there are no open or passage controls. No penalties are assessed for stopping within the confines of a free zone.

Gain - To make up a specified time during passage of a specified or implied distance. The gain time is subtracted from the time required at the given average speed to traverse the distance. The distance in which a gain is operative is a free zone.

GI - General Instruction

Intersection - Any meeting of existent roads (without regard to route designation, surface condition or other characteristics unless such render the road non-existent) at grade level from which the rally vehicle could proceed in more than one direction without making a U-turn.

Left - Turn to the left from 10° to 179°.

Leg - The part of a rally route extending from one timing control to the next, or from an assigned starting point to the next timing control.

NRI - Numbered Route Instruction

OM - Official Mileage

Opportunity - A place at which the specified action could be executed

Pause - To delay a specified time at a named point or during passage of a specified or implied distance. If no named point or distance is given, the pause should be executed at the first opportunity. The pause time is added to the time required at the given average speed to traverse the distance. The distance in which a pause is operative is a free zone.

Paved - A road having a hard surface such as concrete, brick, macadam, etc.

Right - Turn to the right from 10° to 179°

Section - Any part of a rally route at the beginning of which the official mileage is zero and at the end of which the OM ends or reverts to zero.

Sideroad - An intersection of exactly three roads where a road goes generally ahead and another road goes to the left or to the right, but not both.

Stop - An official octagonal stop sign at which the rally vehicle is obliged to stop.

Straight - Proceed within plus or minus 10° of directly ahead at an intersection.

T - An intersection of exactly three roads having the general shape of the letter T as approached from the base by the contestant. It is not possible to execute the instruction straight at a T.

TA - Time Allowance

Traffic Light - A fixed signal light alternating red and green (and frequently including yellow as a transition between green and red) used at an intersection to regulate traffic and which controls the rally vehicle. For rally purposes, only one traffic light may exist at an intersection. A traffic light may be set to operate as a blinker, although it will not be referenced as such, or may not be operating.

Transit Zone - A part of a rally route in which there are no timing controls and in which no specific speed need be maintained. Either an exact time for passage or a restart time from the end of the transit zone must be given. An approximate distance for the length of the transit zone is desirable.

Turn - Change direction by more than 10° at an intersection. A turn instruction cannot be executed if the instruction straight would take the contestant the same way.

U-Turn - Change direction 180° (NTR only - see Article 23.A.4.g) (NCR only - see Article 25.A.4.g).

Unpaved - A road having a non-hard surface such as broken stone, gravel, dirt, etc.

Y - An intersection of exactly three roads having the general shape of the letter Y as approached from the base by the contestant. It is not possible to execute the instruction straight at a Y.

Yield - An official triangular yield sign at which the rally vehicle is obliged to yield.

Appendix B: Useful Formulas for Navigators

As teams get more experienced with Road Rallying, many decide to learn more about the math that goes into the process. We will split this up into a few basic categories.

Basic Time Speed Distance Formulas:

Distance = Speed * Time (in hours) **Example:** 45 miles = 30 mph * 1.5 hours

(Speed in the previous formula is typically the CAST you are driving)

Distance = Speed * Time (in minutes) / 60 **Example:** 1.5 miles = 30 mph * 3 min / 60

(60 in the previous formula converts from hours to minutes)

You can rearrange the three main values of Time, Speed and Distance as follows:

Time = Distance / Speed **Example:** 1.5 hours = 45 miles / 30 mph

Speed = Distance / Time **Example:** 30 mph = 45 miles / 1.5 hours

---

To get minutes per mile or time to travel a given distance, the second equation above yields the appropriate formulas.

Minutes per mile = 60 / Speed **Example:** At 30 mph, Minutes per mile = 2 (=60/30)

Time (to travel Distance) = (60 * Distance) / Speed

Example: At 30 mph, to go 3 miles, Time = (60*3/30) = 6 min.

These formulas can be used to determine the CAST between 2 controls on a Monte Carlo gauntlet. This is a place where two consecutive instructions are controls (call them A and B) and you are given times and mileages for both. (note: OM = Official Mileage in the formula)

Speed between controls A & B =

(OM for B – OM for A) / (Key Time for B in minutes – Key Time for A in minutes) * 60

or **Speed = (60 * Distance) / Time**

Odometer Correction Formulas:

Odometer Correction Factor (OCF) = your mileage / official mileage

Example: If your odometer reads 10.4 miles and the official odometer reads 10.0 miles.

OCF = 10.4 / 10.0 = 1.04. This tells you that your odometer reads long by 4%.

You can then take official mileages throughout the rally and compute the mileage you will see by the following formula.

Your Corrected Mileage = Official Mileage * OCF.

Example: Using an OCF of 1.04 and if an official mileage of 5.45 miles is given, then you will reach that point at 5.67 (= 5.45 * 1.04) miles on your odometer.

The rally will have many average speeds (CASTs). If your odometer reads differently from the rallymaster's odometer, then your speeds will usually be proportionally different also. You can use the OCF to adjust these speeds as well using the following formula.

Corrected CAST = Official CAST * OCF.

Example: With our OCF of 1.04, and a CAST of 34 MPH, we should drive at 34 * 1.04 = 35.4 MPH to adjust for the different in our odometer.

Appendix C: Know your Rally Instruments

To be on course and on time, you must rely on your speedometer and/or your odometer. Some crews use methods that are speed based and some use methods that are distance based, while still others use some combination of the two depending on how busy the navigator is. No matter which system you use, it is important to address questions of instrument accuracy, calibration, compensation and correction.

A key to understanding rally timing is that no two speedometers are the same and no two odometers are the same. Since rallies are, in a sense, based on duplication of the rallymaster's tour of the course, one must be able to somehow synchronize your instruments with his.

Odometer and Trip Odometer

As you know, your car has a device to measure distance called an odometer, usually part of the speedometer. In older cars, it consisted of tiny numbers on wheels that move in an analog manner in some state of rotation as the car moves. In newer cars, this usually consists of a digital readout. For rallying, it is particularly helpful if the odometer readout is to the 1/10 of a mile and if there is an associated trip odometer that can easily be reset to zero.

For analog odometers, it is possible to approximate more than a 1/10 of a mile because you can see how far around it is (for example, if the tenth digit is between 5 and 6, you can approximate the mileage to be .55). This has the advantage of being able to determine precise distances based on a single glance at the odometer or trip odometer.

For digital odometers, you can't determine this based on a single look, so it is important as you are coming to a mileage spot to look and see when the odometer switches to its current value, or more commonly, after the mileage spot to see when it flips to the next digit. This is harder because the driver has to spend up to a 1/10 of a mile looking frequently at the odometer.

The odometer usually works by a gear driven off a cable leading from the transmission. There are two possible problems that you should be aware of:

1. The tires fitted to your car may not have the same rolling radius as the tires fitted to it when it was new (this is especially an issue for historic cars!). If the rolling radius is different, the mileage measurement will be different, but it will be constant and can be compensated for mathematically.

2. If the car has covered many miles, then the odometer gear teeth may be worn. When the trip odometer is reset to zero (usually by pushing on the button or knob on the dash), it is possible that the car will move and the cable rotating by some amount before the teeth are engaged. As a result, the number of feet traveled to cause the trip odometer from zero to 1/10 will likely be

greater than the number of feet to rotate from 1/10 to 2/10 (and all subsequent mileages). If this seems to happen in your car, you may want to rezero at a point slightly before a rally restart point. This point can be learned by the following method.

Find a quiet stretch of road and stop next to a clear landmark of some type (like a road sign), where you can pull off safely. If you have a digital odometer, find a place where your digital odometer just flipped to the next mile (or tenth). Zero your trip odometer and also write down the mileage on your odometer. Drive for exactly one mile based upon your odometer and stop at that point. The mileage on your trip odometer will be slightly less than the one mile your odometer read if you are having problems with gear lash. You odometer, which runs continuously has already taken up the gear lash while your trip odometer must take up the lash before it starts to turn. If you have a digital trip odometer, continue driving until it turns to 1.0 miles to see exactly how far back you should zero your trip odometer in a rally prior to a rezero point.

The final step to understanding your odometer is to check the readings against a standard. This may be the mileage signs on an interstate or against another official measured mile or by using the mileage measurement from a GPS unit. Note, however, that most mileage signs are approximate, and the GPS can have errors depending upon a number of factors, so try this approach with a series of tests to get the most common value for those mileages. For each of these mileages, see whether your odometer is higher or lower than the state highway mileage. The percentage that your odometer is off is given by the following formula.

Percentage difference = (statutory mileage – odometer mileage) * 100 / statutory mileage.

The rallymaster tries to mileage their events close to statutory miles, so this will be a good preview of how your car will likely compare with the mileages on a rally.

Speedometer:

Two methods of keeping time on a rally are the Advanced Seat of the Pants (SOP) method and the related compensatory method. These both are based on the use of the speedometer and the driver makes constant reference to it. These are the methods used by many of the Great Race drivers. For those who will use these methods, it is vital that they understand the workings of the speedometer. This is especially true for historic car owners who have a speedometer acquired at a flea market or off the Internet that is not necessarily the correct one for their car.

The speedometer needle is usually pulled along by a rotating magnet. If the needle is “bouncy” or sticks, then it will be difficult to use these timekeeping methods, without giving the speedometer cable a good lubrication or replacing the cable.

Because the speedometer is not gear driven like the odometer, speedometer error is not constant. It may be different at each speed, which makes compensating for errors more complicated, but it can still be done. You should return to the one mile route that you used for the odometer check above. For this test, you should make sure that it is a relatively straight course without any Stop signs or traffic lights. If you can extend the length of the course to 2, 3, or even 5 miles, that will help reduce errors.

Travel your measured course at 30 mph. Start a stopwatch as you pass the starting mark and then the driver should focus on keeping the speedometer on 30 as much as possible. If we assume your course is 5 miles long, then it should take you 10 minutes to drive from start to finish. Stop the stopwatch when you reach the finish. Repeat this process several times and throw out any times that are outliers from the rest. Note that this repetition may take you an entire afternoon.

Here's an example for this 5 mile course. You have times of 9.83 minutes, 9.76 minutes, 9.85 minutes, 10.12 minutes, and 9.80 minutes. You would throw out the 10.12 minutes (perhaps you got stuck behind a slow car) and average the remaining 4 to get 9.81 minutes. 9.81 minutes / 5 miles is 1.962 minutes per mile. Then 60 / 1.962 gives 30.58 miles per hour. Thus, at 30 miles per hour, your speedometer was a little over half a mile per hour off.

Repeat this process for a series of speeds that will allow you to give a general idea for each speed. I would recommend 20, 25, 30, 35, 40, 45, and 50 mph. Note that you might need different courses for some of these speeds (it seems unlikely you could test the 20 and 50 mph speeds on the same course!).

Clocks, Watches and Stopwatches:

Having a reliable timepiece for keeping the time of day that matches the rally organizers is vital to do well in rallying. You will need the correct time of day at the start and at restarts along the course (such as after checkpoints). If your timepiece reads differently than the official time, you will pick up points even if you run a "perfect" rally. Your timepiece just needs to be good enough to avoid this.

Ability to Set the Timepiece:

In the case of both watches and wristwatches, the single most important feature is the ability to set it easily at the beginning of the rally. There are positives and negatives to both analog and digital wristwatches.

For analog watches, they tend to be easy to set and are easy to read in terms of seconds. The negative for analog watches is that it is often hard to tell exactly what minute you are on. I have seen many teams run a great rally, but enter over half the controls either a minute early or late.

For digital watches, they tend to be a bit harder to set and depending upon the size of the numbers can be harder to read at a quick glance. However, you always know what minute you

are in.

You will have to try each of these to see what you like better. For example, you might utilize a digital watch to determine when to leave restart points (because you know the minute) but then switch to an analog watch (set to the same official time) for use as you run the event.

Legibility:

As described above, legibility is an important aspect for your timepiece. You should think about what you like, but some nice features include:

1. A sweep second hand (for an analog watch)

2. Hashmarks between the numbers (for an analog watch)

3. Uncluttered so that the time can be read accurately with just a glance. This also tends to allow the numerals to be larger than in watches with lots of things going on.

4. Large is helpful. A watch that is good in the office may be too hard to read as you are bouncing down narrow back roads.

5. If you are going to mount the clock in the car, it is most important that the navigator be able to read it easily. You should also test the mounting out in various sunlight situations (if you can't read it in late afternoon, you could have problems in a long rally). You may also want the driver to be able to see it at restart points to help set up for the next leg.

Accuracy:

Your timepiece needs to be good, but space-age accuracy is not a requirement. The duration of most regional and club events is 2-4 hours, and even the longest of events is at most 8-10 hours. As such, unless you are getting major drift, your timepiece should stay on time throughout the event once you set it at the start. You can test the drift by setting your timepiece against either the WWV time signal over shortwave radio (you can also get WWV by phone at 303-499-7111) or the NIST's official time webpage (www.time.gov). Then come back 3 or 4 hours later and see how far off your timepiece is from this "official" clock.

Rally Clocks:

There are specific digital rally clocks that can be purchased that have many features that are perfect for TSD rallying. They are built by small businesses with the brand names Alfa and Timewise. They allow you to hack perfectly and can toggle between seconds and hundredths of a minute. The digits are large and easy to see and also allow you to freeze them to get a better look at the time. The downside is that they start around $200 and they don't have a lot of other uses.

Clocks and Wristwatches:

You can find a number of adequate timepieces on the Internet. If you want something that can be dash mounted, you want to make sure you have a way to get the official time from the rally committee's clock to your dash clock. It is also possible to attach other types of clocks with Velcro to the dash. In general, you should be fine with your daily watch if you are a recreational rallyist, but you should be aware of its limitations.

Stopwatches:

A stopwatch hanging on a string around the navigator's neck can be good for lots of things other than strangling him. It can be used to time pauses in SOP navigation and is vital to many methods of timekeeping. Mostly stopwatches are used to time less than a minute at a time, so the question of accuracy becomes moot, any decent one will do. Some have a time of day function as well, but as they get more complex, make sure that you can read it easily. If you get a digital stopwatch, you should consider one that can read in both seconds and hundredths. Most stopwatches are between $20 and $50 depending on the functionality that they have.

Clock functions on Smart Phones and Tablets:

Our "new" devices have a lot of functionality built in that just wasn't available to rallyists even just a few years ago. Whether you use the "standard" clock functions included with your device or add an "app" for that (more on that later) beware – your device most often will have GPS functions built in also and that may NOT be allowed in every rally.

Appendix D: How to Plot Map References

Defining a route by using map references is a method used all over the world. It is especially popular in the UK, where it is almost universally used for road rallying. In the UK, they have a national grid map system and the Landranger series of Ordinance Survey Maps are widely available in bookstores there, in either book or computer program format. We have nothing like that in the US, but the popular ADC County map books are adequate for this purpose.

In the ADC County maps, each county is divided into rectangular sections of approximately 10 by 13 inches. Each rectangle is numbered in an upper corner with the map number. In each map, north is towards the top of each map. On map rallies in this area, you will be given several copies of these maps, where you will plot the route.

Superimposed on the maps is a grid of squares that are about 1 x 1 inch. Across the map are the letters A through K which define the column. Down the sides, the rows are defined by numbers, usually 1 through 13. Using these letters and numbers, each square can be given a unique identity. Within each square, more precise locations can be plotted with a device called a Roamer.

Roamers come in a variety of sizes and shapes, but are usually clear plastic with a grid that corresponds to the size of grid square on the maps being used. The Roamer is divided by 10 evenly spaced vertical and horizontal marks.

A position on the map can be described by a Map Reference which consists of a information about which grid square to look in and also which tenth of the square to look in, both in the east/west direction (an “easting”) and north to south (a “northing”). Map references contain “eastings” and “northings” separated by a slash (/). The map reference rule is “Always plot eastings before northings”.

“Eastings” are to the left of the slash and refer to the horizontal square identifications A thru K and therefore being with a letter in order to identify the square. The next digit refers to the tenths division within the square. An example of an easting would be E07/. We include a 0 before the tenths division here to ensure we have three characters both before and after the slash.

The “Northing” consists of the digits to the right of the slash. The first two digits in a “Northing” are 01 through 13 and define the square in the vertical direction. The remaining digit refers to the tenths division within the square. An example of a northing would be /068. The full example that we have discussed would be E07/068.

Now, we discuss how to plot a point on the map using our Roamer. We begin with a simple example. Let’s consider the map reference E05/065. Using the information from above, we see that this is in grid square E06. In this example, we go both 5/10 (or halfway) from left to right

and 5/10 from bottom to top. As such, this map reference is in the middle of grid square E06.

As the example for the remainder of this section, we will plot the map reference H03/129. From the first character in the easting, we take the "H" and from the northing, the first two characters "12". Thus, the map reference is somewhere in grid square H12.

The 03 in the easting says that we are 3/10 of the way across the H square. Similarly, the 9 in the northing says that we are 9/10 of the way up the 12 square. You can do this with a Roamer in the following manner. Place the upper right hand corner of the Roamer at the lower left corner of square H12. Now, remembering the "easting before northing" rule, slide the Roamer right until the 3rd division of the Roamer is aligned with the leftmost edge of the square. Then to plot the northing, slide the Roamer up until the 9th line is even with the bottom edge of the square. The map reference point is at the upper right corner of the Roamer. You could be off by as much as 1 square in the Roamer, and almost always the map reference will be on a road.

In a rally that uses map references, they will be given in order and you will plot your route by connecting the map reference locations using the shortest available route. This is the route that you would drive.

Appendix E: How to Run Monte Carlo Style Rallies

A Monte Carlo style rally is perhaps the best for new rallyists to get comfortable with following a route because the route instructions include exactly where the checkpoints are located along the rally route. Key times are given for arrival at each control along with a mileage for its location. All you need to do is drive the course and get to each of those checkpoints exactly on time. Sounds easy, doesn't it?

In fact, it is pretty easy, but everyone has the same information at their disposal, so scores tend to be low. Some people refer to Monte Carlo rallies as checkpoint entering events as the best teams want to get 0s at most controls instead of 1s. As such, you need to develop a strategy for getting into controls that you can use over and over again throughout the day. We consider two possible strategies now.

Option 1: (Note: This doesn't work!) You could drive briskly to the control location, arriving early before your arrival time, wait out the remaining time and simply drive into the control on time. This is mostly good, except the stopping at the control location. On most Monte Carlo rallies, you are penalized for stopping in sight of the control and some rallies even penalize you for creeping (driving "slowly") into the control. Because of these penalties, this method doesn't work.

Option 2: We'll take the good things from Option 1, driving briskly to NEAR the control location. We typically mean for teams to drive to a point 0.5 miles before the control location (since you know the mileage of the control, simply subtract 0.5 from it to find this point). This point is commonly called a standoff point or a jumping off point. If you leave the standoff point 1 minute before your arrival time at the control and drive exactly 30 mph until you reach the control, you should arrive exactly on time. Why? Because at 30 mph, it takes you 2 minutes to travel 1 mile (and thus, 1 minute to travel a half mile).

We now go into more detail on how to make Option 2 work for you. Once you leave the standoff point, it should take you 12 seconds to go each 0.1 mile. The navigator should give the driver a "hack", that is, somehow letting the driver know as each 12 seconds elapse. This can be done either by saying "hack" or saying "0.4 miles to go" (or 0.3 miles to go, 0.2 miles to go, or 0.1 miles to go). All that matters is finding a method that the team can agree on and works for them. In addition, the driver and navigator (as much as possible) should be scanning the side of the road for the checkpoint sign. Once the checkpoint has been observed (or at 12 seconds before perfect time at the control) the navigator should just look at the clock and count the driver down to 0. The driver should adjust the car speed to pass the checkpoint as the navigator says 0.

Sound easy? There are some problems that can come up!

1. Occasionally, you will have to follow route instructions between the standoff point and the control. This will take time (especially if you have to make left hand turns). As such, you should

get closer to the control before creating your stopping off point.

2. Usually during a Monte Carlo rally, you will enter what we call a Gauntlet section. This is a series of multiple controls within a short period of time and distance. For example, after you enter the first control using your normal method, you might only have 38 seconds to go 0.3 miles. What should you do then? Remember that it takes 12 seconds to go each 0.1 miles at 30 mph. As such, it would take you to go 36 seconds to go 0.3 miles. So going a bit faster than 30 mph (maybe 31 mph) between these controls should work in this case. The navigator should give lots of information to the driver, such as "keep going 30", "Hack for 0.2 miles to go" (since you probably missed the 0.3 miles to go hack because it was just after the last control!). The key for a gauntlet is to keep the driver focused on finding the controls and the navigator giving as much information as they can right after each control and then giving a good countdown going into each control.

Another (harder) example is if you only have 38 seconds to go 0.4 miles. At 30 mph, it should take you 48 seconds to go 0.4 miles, so you will need to drive significantly faster than 30 mph to get to the control. Typically, if you know the speed limit, the speed to drive is usually right around the speed limit. This is likely in a 40 mph stretch, and going 40 mph will get you to the control a few seconds earlier than your key time.

A gauntlet is always the hardest part of a Monte Carlo rally, but having a plan for what to do going in helps. When you receive your route instructions, you should look for places with consecutive controls and determine the amount of time and distance you have between controls. That way, you will know if you should keep going 30 mph or if you need to go faster. You can also compute the exact speed the rallymaster should go between consecutive controls, call them A & B, by the following formula (Note: OM stands for Official Mileage).

Speed between controls A & B=

60 * (OM for B - OM for A) / Key Time for B in minutes - Key Time for A in minutes)

You will then need to use your Odometer Calibration Factor to convert that speed to the speed you should drive based on your speedometer.

3. Another problem you can face is that your jumping off point is on a very twisty road and the speed limit is marked at 25 mph. It could be dangerous to try to drive at 30 mph. Similarly, you might see that your jumping off point is on a wide straight road with a Speed Limit of 45 mph. It could also be dangerous to drive at 30 mph if a local is barreling along at 55 mph! As such, you need to be prepared for how to adjust speeds and jumping off points for different situations. The Cheat Sheets on page E-4 give you that information in both seconds and hundredths of a minute.

Helpful Hints:

1. Make sure to use your odometer correction factor to calculate the corrected distances for each control. You can also subtract the 0.5 miles from these corrected control locations to get approximate jumping off points. Working together, the driver and navigator can complete this exercise together at the end of the odometer check.

2. The key times are given in the instructions for Car #0. You will either need to fix all the times in the routes by adding your car number in minutes (i.e., if you are car #12, add 12 minutes to the key times) OR set your clock earlier by the number of minutes as your car number (i.e., as car #12, setting your clock 12 minutes earlier than official time) and then just use the key times given in the routes. Do **NOT** do **BOTH** of these on the same rally!! Using either method, you will need to be careful when adding in a TA.

Jumping Off Tables:

On the next page, we give two tables that you can use to determine how long it will take you to get to the control based upon a variety of speeds and distances from the jumping off point to the control. The top table is if you are timing in seconds and the bottom table is for use if you are timing in hundredths of a minute. We now work two examples of how you can use these tables.

Example: If you are on a fast road, where the safe speed to drive is 40 mph and you have reached a jumping off point 0.3 miles from the control. By looking up the row for 40 mph and the column for 0.3 miles in the tables, you will find that it will take you 27 seconds or 45 hundredths of a minute to arrive at this control.

Example: Similarly, assume you are on a slower road and you want to drive into the control at 24 mph and your jumping off point is 0.5 miles from the control. In this case, looking into the tables, you see it will take you 75 seconds or 125 hundredths of a minute to arrive at this control.

Monte Carlo Standoff Cheat Sheet (times in Seconds)

Speed	Distance (mi.) 0.5	0.4	0.3	0.2	0.1
20	90	72	54	36	18
24	75	60	45	30	15
25	72	58	43	29	14
30	60	48	36	24	12
35	51	41	31	20	10
40	45	36	27	18	9
45	40	32	24	16	8
50	36	29	22	14	7

Monte Carlo Standoff Cheat Sheet (times in Hundredths)

Speed	Distance (mi.) 0.5	0.4	0.3	0.2	0.1
20	150	120	90	60	30
24	125	100	75	50	25
25	120	96	72	48	24
30	100	80	60	40	20
35	85	68	51	34	17
40	75	60	45	30	15
45	67	53	40	27	13
50	60	48	36	24	12

Appendix F: How to do it - A Guide to SOP Rally Techniques (by Elliott Woodward)

1. So what's an Odometer Check?

Everybody's speedometer reads a little differently. If three cars are going down the road at the same speed, mine may say that we are going 50 mph, while yours says 48 and the other guy's says 51. The Odometer Check lets you see the difference between your speedometer and the rallymaster's. This is important, because the speeds for the rally were set on their speedometer, and you've got to go their speeds.

Measure the distance for the Odometer Check on your odometer. At the end of the Odometer Check, stop and compare your distance to the distance given in the route instructions. If your distance is 5% less than the rallymaster's, then your indicated speeds also must be 5% less - if they say to go 40 mph, you go 38 on your speedometer; it's just your speedometers that disagree.

To find your exact correction factor, divide your measured distance by the distance in the instructions. The result is your factor, and it will usually be between 0.95 and 1.05. If yours is 0.975, then you have to indicate speeds 2.5% lower than rally speeds. Similarly if it is 1.04, you have to indicate speeds 4% higher. This may not sounds very important, but if you choose to ignore a 2% factor on a two hour rally, at the end you'll have a 2 ½ minute error because of not applying your factor, even if you do the rest of the rally perfectly.

2. Staying on Time

Staying on time is a very difficult thing to do, if you want to win. How do you know exactly what speed to drive? How do you make up or even measure the time you lose at stop signs? What do you do if the rally says to go 48 mph, but the truck in front of you is gong 37? What if you're given a speed change that takes you from 18 mph to 55 mph? The Odometer Check takes care of part of your problem; it sort of tells you what speeds to drive (I'll cover the 'sort of' in a minute). Some SOPers ignore the Odometer Check, figuring that a correction of only 1 or 2 percent is only important to the computer types. These people are beaten before they start. Often the winning time in SOP class is less than 1% of the driving time for the rally. After you've figured your odometer factor, what do you do with it? Well, you adjust your speeds by that percentage. Figuring this percentage in your head is not hard; to get 1% of any speed, you just move the decimal place 2 places left. For example, 1% of 37 mph is 0.37 mph. So let's say your factor tells you to run 2% slower than the instructed speeds. If the rally says to go 40 mph, you decrease it by 0.80 (0.40 is 1% and multiply by 2 to get 2%) and drive at 39.2, or 39, right? Wrong.

Unfortunately, in most cars, there is another built-in error factor - the difference between your

odometer and your speedometer. They are both driven off the same cable, but usually the speedometer needle is moved by a magnet. This means that when your front wheels are gong 50, your speedometer may be saying 52. To find out what this error is in your car, find a good empty road some morning and do this: drive at a constant speed (say 50) and wait for a tenth mark to come up on your odometer. Have the navigator start a watch and drive at that speed for exactly one mile, as indicated on your odometer - never mind that it isn't a real mile. At 50 mph, a real mile takes 1.20 minutes - 1 minute and 12 seconds. If your odometer is off 5% and your speedometer is also off 5%, you'll do your indicated mile in exactly 1.20 minutes. At 40 mph, you'll do it in 1.50 minutes, 2.00 at 30 mph, 2.40 at 25 mph, and so on. Run your indicated mile at each of these speeds several times, so you can get a good average speed reading at each speed. Now let's say that at 40 mph your times were 1.53, 1.55, and 1.52. Your average is around 1.53 and it should have been 1.50. 1% of 1.50 (remember to move the decimal left 2 places) is 0.015, and you're slow by 0.03, so you have a 2% error at 40. Check other speeds as well; the error probably will increase as the speed goes up. So what does it mean? Suppose you find there's a 3.5% error in your speedometer at 50. You're on a rally and your odometer factor says you have to run 2% faster than the rally speeds. So when the rally says go 50 mph, you have to increase that by 2% (1 mph) for your odometer factor, and then increase it again by 3.5% (1.75 mph) because of your car's error, because when your speedometer says 50, you're only going a bit over 48 mph.

Trying to do two factors at once is mucho hard. The way the errors have worked out in my Z, I just remember that I have to increase all my speeds by 1 mph at anything from 20 to about 33, 1.5 mph from there up to about 45, and 2 mph from there on up. So I just correct each speed according to the odometer factor I have for that event, and then add the right amount to correct for the error in my speedometer.

If you do these two things right, the Odometer Check and the speedometer error, you will be a couple of minutes ahead of most SOP cars right off the bat.

3. How to Make up Time

Being late is horrifying to beginning SOPers; they will do anything to avoid it, even to the point of such idiocies as running Stop signs. This is a very dumb idea; it gets you tickets and/or gets your car bent. Worst of all, intersections are where most of the nasty, hard to see signs are hidden. By avoiding a few seconds of late time, you are liable to end up with a max for missing a sign. Once you know how to get back on time, you will find that being a little late is no problem.

How do you measure time lost at a Stop sign, with decelerating, acceleration, speed changes and all that garbage going on? Go find a straight empty road with no stops and pick 2 landmarks a few tenths apart, like a tree and a billboard. Have your navigator time your travel at 30 mph between the two landmarks. Now, do it again, but pretend there is a Stop sign in the middle of

your run. Stop, look both ways, and crank it back to 30. The new watch reading at the billboard tells you how much time you lost making a stop at 30. Do this for a bunch of speeds.

That's all some people do. They remember that they lose say 5 seconds at 30, 8 at 40, and so on. That's fine, but what happens when you have to wait at the Stop because a truck is coming? Rather than assume you're always going to lose the same amounts, it's better to have a watch running and get an exact figure each time. So go back to your empty road.

You've found that you lose X seconds when you stop in a 30 mph run. Drive at 30, and find an imaginary Stop sign. When you've slowed to half of the rally speed (in this case 15), start your watch. Stop the car and accelerate back to 30, stopping the watch when you are back up to half the rally speed (again 15, in this case). The watch should read almost exactly the same X seconds that you've determined you lose at 30.

If your car is a bunch faster or slower than mine, you will have to leave your watch running a little more or a little less time than half speed to half speed. The point is, you can develop a method for measuring your dead time exactly, and the nice part is it works with speed changes and trucks too. If you are going 20 mph and the rally says "Right at Stop. CAST 60". You start your watch when you've slowed to 10, stop the watch when you get to 30, and you know cold how late you are.

The other main place where you lose time is when you go off course, realize it, and turn around to get back on. Now, how late are you? This one takes guts, because what you want to do when you turn around is stuff your foot in it. Here's a better way, start a watch when you start to turn around. Drive at the same speed back up the road as you were driving coming down. When you get back on course, you are late exactly twice the amount shown on the watch. If you are good with numbers, you can save yourself some time. Say you are going 30 and you find you are off course. You start a watch, turn around, and head back at 45. When you get back on course, you know you're late by 2 ½ times the watch value, because you came back at 50% over the assigned speed.

So now you know how late you are, but how do you get back on time? The way most of us do it is by, percentages: if you go 10% over rally speed, you gain 1 second every 10 seconds; 25% over, gain 1 second every 4 seconds; 50% over, gain 1 every 2 seconds. If you are 10 seconds late, you can make it up by driving 10% over speed for 100 seconds, or 25% over for 40 seconds, 33 1/3% over for 30 seconds, etc. If a speed change comes up in the middle of your make up time, you just change speed so that you stay the same percentage over the assigned speed. Say you are 10 seconds late at 40 mph and from the look of the road you think you can make it up by going 20% over for 5 times the lost time: 50 seconds. You go 48 (20% over) for a while and you hit a speed change to 20. Fine! Change speed to 24 (still 20% over CAST) and wait for the rest of your 50 seconds to run out.

This also works the other way, if you drive 10% below rally speed, you only lose 6 seconds per

minute (1 second every 10 seconds). So if you are in an area where the signs are hard to read, don't fight it; slow down, start a watch, find the sign, and then make up the time when you're not hassled. This is also how, you handle the truck in front of you that's going 11 mph slower than you're supposed to go. Don't kill yourself passing him and don't panic; pick a percentage below rally speed that you can drive, figure the lost time, and make it up later. This is exactly what the computer people do; that do it by measuring distance, you do it by measuring time and speed.

Once you can consistently make up the 10 or 15 seconds you lose at Stops, you can go after the 2 or 3 you lose in corners. We all have to slow for at least some of the corners, and this obviously costs time. I make it up by the percentage game, but Dave Harris had a really unique way of handling it. He'd treat a tight corner as a Stop, because he knew he could make that up perfectly. It was a little unnerving to be close behind him on a road like 142 (Carbon Canyon), watching him stop in the corners and smoke off on the straights. An unorthodox technique, but it worked well for the Harrises.

The easiest way to make up time is to arrange things so you don't have to; run early! I leave checkpoints and pauses about 25 hundredths early most of the time, so when I get to a Stop or an area jammed with signs, I can check things out for 15 seconds before I have to get nervous. Then when the road straightens out and I'm not looking for three things at once, I use my formulas to get 25 hundredths early again. Doing this takes a lot of pressure off Stop signs and such, but I run the risk of getting zapped at quick checkpoints. So I leave checkpoints right on time if I can't see where the road goes or if it feels like a good time for a quick leg, and during each leg I drop back on time when I'm in an area that might have a checkpoint.

Usually this works out fine, but sometimes I guess wrong. On a La Mirada rally last year, I smelled a checkpoint and paused out the 25 hundredths that I was early. I promptly got 20 late at a Stop and found the checkpoint right around the corner. I took a 14 on the leg, 33 total for the rally, and lost to a team that had 25 total. Another time I was 25 early on a road that couldn't possibly have a checkpoint on it, but it did. I stopped right at the timing line, and took a 3 on the leg, plus a 1 minute penalty (richly deserved) from John Classen for stopping right in front of the checkpoint. So you can still get in big trouble, no matter how many fancy formulas you use.

4. It's Not All Staying on Time

I may have given the impression that to be a good SOP competitor you need to keep both eyes glued to the speedometer at all times. Unfortunately, if you do that you'll not only lose rallies, but you'll probably customize your car against a tree. The business of holding speeds and making up time is the icing on the cake; you need it to beat the other good SOPers and you need it to occasionally knock off the people who run with instruments. However, you need to be able to do it automatically, almost in your sleep, because your real concentration is needed to keep you on the road and on course.

Practice holding speeds without looking at the speedometer. Set the car at 45 mph, watch the road for a while, and then look down and see how far off 45 you are. During a rally, you can't stare at your speedometer; you'll have to stay on speed just glancing at it once in a while. If you catch yourself a little below speed, don't just go back to the right speed; drive a little over speed for a bit to compensate.

One final piece of advice for beginning rally people: Ignore this article for several months. Run as many rallies as you can, ask a million questions, and concentrate on learning how to follow instructions, how to interpret various club's general instructions, and how to stay on course. Then worry about making up time for Stop signs. Knowing how to make up time doesn't help when you're falling for all the traps. If you want to get good fast, run the hardest rallies you can find, and then get the people to explain thoroughly any trap you fall for. You don't become an Olympic skier by staying on the bunny slopes.

This guide was written by Elliott Woodward, who with navigator Rick Turner, won the 1975 SCCA National Rally Championship in Class B using these techniques.

Jeanne English, an expert current West Coast competitor has added the following two sections to this guide.

5. On Being Held up by a Slower Vehicle

As soon as you realize that you will have to travel at a slower speed than the assigned CAST, pick a speed that you can drive and that is a fraction/percentage of the assigned CAST. For example, if the CAST is 40, your choices could be 10% slower (40 - 4 = 36), 20% slower (40 - 8 = 32), etc. Start a stopwatch and time how long you are traveling at the slower speed. At 10%, you lose 10 hundredths for every minute you travel at the slower speed, at 20% you lose 20 hundredths, at 25% you lose 25 hundredths, etc. If you do not lose a full minute, you lose a proportional amount, i.e., for a half a minute, you lose half the amounts listed above.

When you have the total lost time, use the charts to determine how to make it up.

6. Taking a Time Allowance (TA)

How to take a TA depends on the TA rule for the event:

1. If the TA can be for any amount, simply ask for the amount you lost.

2. If the TA must be for a specific amount, say a multiple of 0.5 minutes, then figure out how

much you have already lost and pause any additional time needed to make the correct TA amount. For example, if you lost 1 minute and 20 hundredths by being off course or driving below CAST, then pause an additional 30 hundredths to bring the pause to the next 0.5 minute increment.

EZ Rally Timing
by Gary Starr

Looking for a stock odo timekeeping technique that has the accuracy of a computer yet is so easy anyone can do it with just a clock and 4-function calculator? Try this proven one:

EZ Rally Timing Method

Step 1. At the odo check, compute and record the corrected minutes per 0.1 mile factors for all the casts of the entire rally in the following format:

T.TTTT0DDD (for 10 digit calculator)
or
TT.TTTDDD (for 8 digit calculator)

where `TT.TTT(T)` is the corrected min/0.1mi and `DDD = 001` (DDD is distance in 10's, 1's, 0.1's miles).

Example:

CF (correction factor) =
your net mileage @ odo check / official net mileage @ odo check

`CF = 10.25 / 9.85 = 1.040609137`

Cast = 40

(Since corrected min/mi = 60 / (cast * CF), then)

CORRECTED MIN/0.1 MI = 6 / (CAST * CF)

`= 6 / (40 * 1.040609137) = 0.1441xxxxx`

Record for cast 40:

`0.14410001` (for 10 digit calculator - truncate to 4 decimal places, add 3 zeros and a one)

or

`0.144001` (for 8 digit calculator - truncate to 3 decimal places, add 2 zeros and a one)

Step 2. Enter into memory the factor for the first cast.

Step 3. Now clear the display (but not memory) and enter your out time in the same format where TT.TT is your out time and DDD is your odometer reading at the out-marker (or place where TT.TT is your out time).

Example:

Out time = 21.00, odo = 36.4:

Enter into display:

21.00000364
(for 10 digit calculator - out time in minutes, decimal, 5 zeros, odo)

or

21.000364
(for 8 digit calculator - out time in minutes, decimal, 3 zeros, odo)

Step 4.

Now press +, MR (memory recall), =

And presto - you have the TOD clock time TT.TT (eg. 21.14 min) for the odo mileage DD.D (eg. 36.5 mi)!!!

(display reads 21.14410365 for 10 digit calculator)
or
(21.144365 for 8 digit calculator)

Step 5. Keep pressing = to match DD.D to your odo, and wah-la, you can give hacks every 0.1 mile if you wish (like when approaching a control - eg. 21.28 min @ 36.6 mi, 21.43 min @ 36.7 mi, etc.) with accuracy that will rival a computer. You can easily get 2's or less with a steady driver (Dave Fuss and I got 8 points in 10 controls using this system with just a checkpoint TOD clock and stock odo!).

OR

Just press = enough times to match any odo reading at which you want the time.

Notes:

When the time exceeds 60 (the hour), just subtract 60. Then press +, MR, = to continue for the next 0.1 mi.

At speed changes, press = until the mileage matches your odo, record the result (entire display), enter the new factor into memory for the new speed, and go back to step 3 using the recorded figure as your out time to enter in the display.

Pauses/gains are done normally (+ pause =, - gain =) followed by +, MR, = to continue for the next 0.1 mi.

Equipment needed:

1. 0.1 mi reading odo (don't need or will use reset).

2. 0.01 minute TOD (time-of-day) clock (checkpoint clock is fine).

   - Alfa (led/lcd) - (603) 895-9429
   - Chronar (incand/lcd) - (206) 481-0748
   - Timewise (lcd) - (708) 291-1275
   - WesTek (lcd) - (219) 489-8855
   - Zeron (led/lcd)

   The above clocks are available through the manufacturer or:

   - Bob Radford Enterprises - (815) 398-0511
   - Competition Limited - (313) 464-1458

3. 4-function calculator with 1 memory (to be class S "unequipped" legal):

   - Separate memory store and memory recall buttons.
   - Battery (can also have solar but must have battery).
   - Memory not lost on auto shut off.
   - Constant memory operations (+, MR, =, =, = adds memory contents 3 times to display but leaves memory unaffected).

   Other desirable but not absolutely essential calculator features:

   - Large display digits.
   - 10 digit display.
   - 1 + 2 x 3 = 9 (not 7)
   - = button in corner (eg. lower right) to minimize accidentally pressing/bumping the wrong button.
   - Switch to keep power on all the time (good luck finding it) or at least a very long auto shut off time (most calculators turn off at 6-12 min of no activity).

   Calculator recommendations:

   - Sharp EL-480G (10 digit display - fits in a shirt pocket - $10 at Office Max)
   - Sharp EL-354LB (Larger 10 digit display - $15 at Office Max)
   - Sharp EL-334LB (Large 8 digit display - $10 at Office Max)

   Beware: Most calculators (except those above) loose their memory after auto power off.

A few usage notes:

1. The calculator MUST HAVE the constant memory operations feature: (+, MR, =, =, = adds memory contents 3 times to display but leaves memory unaffected).
2. I thought off course would be obvious so I didn't mention it, just: -, MR (memory recall), = and then keep hitting = until the mileage matches where you went offcourse (you can wait till you return to the place you went offcourse to do this). Then (now on course), add in a pause for your offcourse time allowance delay and hit +, MR, = and then continue hitting = to match your mileage as before. Of course it gets a little tricky if you had a speed change or an hour change during the offcourse but I think you can figure this one out (that doesn't happen very often anyway).
3. Remember the +, MR, = (or the -, MR, =) counts as one of the 0.1mi increments.
4. There's no limit on how many 4 function calculators you can have (so you can have a 2nd one preset up for the next speed if you like).
5. The accuracy is extremely high but the resolution is only 0.1 mi. This means speed changes between the tenths will get "averaged out" and so the time will not be exact (like a 0.01 or 0.001 reading odo will do). It is well worth this trade off, however, for class S or SOP since it is so easy and quick to just keep pressing the = button every 0.1 mi. (or to just match your odo when you want a time) as compared to other methods where there are additions (or watches to manipulate) which take more time, effort, invite mistakes, and/or can't be done as often. Also the times you get with this method are usually accurate enough to beat all S cars anyway on all local events.
6. The display right shifts when it zero blanks the rightmost digits (eg. when the tenths of miles flips over to xx.0 the display right shifts and blanks out the rightmost 0's). This takes some getting used to. I experimented with other ways (reversing time and distance on the display, putting the decimal in the distance instead of the time, etc) but I felt they where all more confusing and had many more drawbacks than this way.
7. When there is nothing but 0.1 mile digital odo cars around, this system may get more popular.
8. For legs which have only one speed this is a great system. Rene Ruel (national S champion) told me he uses this method on nationals for the 1st speed of the leg since it is completely accurate until a speed change. Also because on some events there ends up being only one speed on a leg (after a speed change he switches to a more accurate and labor intensive method needed to compete at the national level). Additions, subtractions, and watch manipulations all make stock odo rallying miserable and unenjoyable for most people (there are always a couple diehards of course).

(rev 4 - 03/07/96)

Email comments/questions to Gary Starr

Appendix H: Explanation of RoadRally Scoring

Of all the concepts in rallying, for some, scoring is the most mystical. More than one rookie rallyist will come to the end of the event having no real idea how they did, and can be seen looking at the scoreboard, scratching their head as to why this leg was a 50 while another was a 10. Knowing how to score yourself will help you to better understand what is happening with the rally. This knowledge will allow you to:

1. Understand how well you did leg-to-leg, right after getting your time and the perfect leg time

2. Come into the finish with a completed scorecard

This completed scorecard will be the official score (once audited by rally officials) in events with open controls. On other events, it will be unofficial, which happens frequently in events with Passage Controls. Once you get the official leg times, you can get tentative scores, which will allow you to compare your expected scores with the results on the scoreboard. On passage control events, you scores may be one or two off from those obtained by the committee because you and the control crew may have stopped your clocks at slightly different times. This will allow you to potentially find mistakes by the official scorer, which occasionally will give you a better score, just because you computed your own scores.

For this section, we will use the scorecard with the first 5 controls filled out (below). Scoring on this rally (as in most other events) is 1 point per 0.01 minutes early or late on a leg. The creeping penalty (imposed on cars that slow to a crawl, stop, or take other evasive action in sight of a control) is 25 points (with the leg total not to exceed 100 points). The information on the Time In and Time Out lines is typically entered by Control Crews, except in the case of DIYC controls. The Official Leg time is typically found on the control data slips handed to you by each control crew. Then you can compute everything else on the scorecard.

Each leg score is fundamentally computed by subtracting the out-time (the time you start the leg) from the in-time (the time you arrive at the end of the leg). For the first leg, your Time Out is the start of the rally plus your car number. In this case, the start is at 8:00 plus car number, so we are Car #7 and our out-time is 8:07.00. When you arrive at the first control, the control worker will enter the in-time for Leg 1 (8:53.34) in that blank, as well as give you the out time for Leg 2 on your scorecard (8:57.00). At this point, you will have the ability to compute the leg time for leg 1 (we assume you are given a control data slip at each control of the rally, which gives the official leg time). In this case, the official leg time is 46.17. Copy this information into the appropriate block. You can subtract time out from time in to get Car 7's elapsed time (46.34). Then, you can compute the difference between the Elapsed Time and the official leg time to get the Time Error (0.17 minutes). This gives you a score for Leg 1 of 17. Note that while early or late is unimportant to the actual score, tracking this can help you improve (i.e., understanding that you are often late or early will allow you to adjust). If your time error is positive, you were late, while negative time errors indicate early arrivals.

When you arrive at Checkpoint #2, the control worker will again enter the in time (9:05.79 in this case) and the new out time for Leg #3 (9:10). Compute the Leg #2 score in the same manner as the previous leg.

When you arrive at Checkpoint #3, you inform the control worker that you are taking a 4.50 minute Time

Allowance (TA) because you got stuck at a railroad crossing. There is no penalty for this, but the TA must be in multiples of ½ minute (0.50, 1.50, 2.50, etc) and must be declared BEFORE getting any scoring information from the control crew. The worker will validate this information and you or the control worker should write the TA in the proper block for Time Allowance. In some cases, you will be asked to initial the TA. Now, in order to compute your score, you must take this TA into account. After you compute the Elapsed Time as before (in this case 17.15), you must subtract off the TA from the Elapsed Time to get the Corrected Time, which is then compared with the Official Leg Time to calculate your score.

Leg #4 is a Do It Yourself Control. This type of control MAY appear on some rallies. If your rally has a DIYC procedure, follow it. A common DIYC procedure is shown here. In this case, you record your arrival time at the DIYC in the Time In block for Leg 4. Assign yourself an out time for Leg #5 by adding exactly 2 minutes to your Time In for Leg 4. This means that your starting time will usually not be on an even minute, in this case you will start at 9:42.44. Note that you don't actually have to arrive at the DIYC at the In Time. The DIYC is about running the leg correctly, and calculating the correct time of arrival. In general, it doesn't make sense to use a Time Allowance on a DIYC leg (since you can just put the corrected calculated time as your In Time). Although you won't have the official leg time yet, you can go ahead and calculate your elapsed time now, if you want.

When you arrive at Leg #5, the control worker will give you the in time for that leg. He or she will also generally record, or perhaps "seal" your declared DIYC time from the previous leg. You CANNOT change your DIYC time once you arrive at the next control. You will generally be given two leg slips at this time (one each for legs 4 and 5). You can then compute your scores for both of these legs (independently). Be careful when scoring Leg #5 as the non-round start time makes for trickier calculations (especially for an otherwise busy navigator).

This leg should be just like all the rest, but in this case, you were running very early, and when you saw the control, you stopped to try to burn off time. Most rallies will impose the penalty if the control crew waves you in and you don't immediately go into the control. In this case, you managed to enter the control 0.01 minutes early, but because the control crew gave you a creeping penalty, given as 25 points in this example rally. This results in a total score for Leg #5 of 26.

Now, as you head towards the finish, you can add up your scores and get your total score for the rally. In this case, the total is 17 + 22 + 3 + 100 + 26 = 168. If this is the official scorecard, you may want to copy the pertinent information down for yourself (at least the leg scores), since you will hand this card off to a rally official for auditing and posting. On some events, the scores will be computed entirely from the control logs, and you can keep this scorecard. In that case, you can use it to check against the official scores when they are posted.

Hopefully this brief tutorial provided a good explanation of how to self-score throughout an event and why this is important to do. Note that there are variants in this procedure, depending upon the event. If the event contains passage controls (i.e. you don't stop after each checkpoint), then you can only estimate your in time by looking at your own clock when you cross the checkpoint line, and you may not get the official time until the end of the event. A Monte Carlo event may be similar, except you have the official times right in the route instructions. In these cases, you will still want to check at the end to make sure your

scores are at least close to what you expected (timing differences of 1 or 2 per control are common on these events though, even if you thought you marked the time perfectly.

Finally, as with all aspects of rallying, if you have any questions on a particular event, find someone to ask.

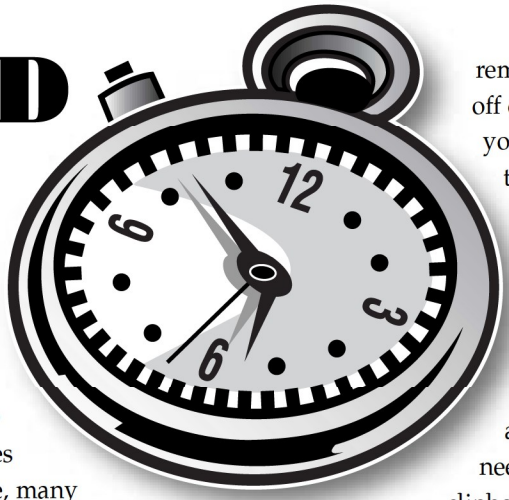
Official Scorecard – Example Rally School Rally

Driver: Speedy Gonzales Navigator: Len Picton Car # **7**

Class: Stock

	Control 1	Control 2	Control 3	Control 4	Control 5
Time In	8:53.34	9:05.79	9:27.15	9:40.44	10:01.33
Time Out	8:07.00	8:57.00	9:10.00	9:31.00	9:42.44
Elapsed Time	**46.34**	**8.79**	**17.15**	**9.44**	**18.89**
Time Allowance			**4.50**		
Corrected Time	**46.34**	**8.79**	**12.65**	**9.44**	**18.89**
Official Leg Time	46.17	9.01	12.68	8.10	18.90
Time Error	**.17**	**.22**	**.03**	**1.34**	**.01**
Other Penalty				**max**	**25**
Score	**17**	**22**	**3**	**100**	**26**

Basic TSD "Stock" Rallying



By Dennis Blevins

Back when our little British cars were new, one of the popular weekend pastimes was road rallying. There was, and still are, many different types of rallies put on. The most basic were TSD (time, speed, and distance) events with "stock" equipment on the car, namely, the speedometer, odometer, and a timepiece. As competitors tried desperately for better and better scores, all kinds of devices were developed to assist in calculating perfect leg timing as you followed the course. These included standard slide rules, calculating wheels and drums (that work much like a slide rule), and variably adjustable speedometers and odometers. This has evolved to the point today that specially designed computers tied directly to one of the non-driven car wheels are used by the most competitive teams. Typically, these "equipped" teams can easily expect to run a 200 mile event with close to two dozen checkpoints with less than 10 one-hundredths of a minute error over the entire event! Unfortunately, such fierce, precise competition has caused the "amateurs" to leave the sport to literally a couple of hands full of teams across the country. Fortunately, some local clubs such as our MGs of Baltimore neighbors still put on some events that all of us can compete in and have some fun. It does take a bit of work, but here are some pointers.

I. General Items

Remember, the point of a time, speed, distance rally is to follow a course laid out by the rally master as close as possible to as the exact same time, speed, and distance as he set it up. There will be checkpoints along the way to see (score) how you are doing. Too fast is as bad as too late. Each leg (between each checkpoint) is scored separately - If you're late on one leg, don't try to make it up on the next one. Rallying is like golf, the lowest score wins, and like golf, it takes practice and preparation to win. And remember, the first rule is "don't go off course". It doesn't matter how well you can keep time or calculate time-to-travel-distances if you're on the wrong road!

Prepare ahead of time. Register early, arrive early. Make sure your car is serviceable and topped up with fuel, oil, and coolant. (And make sure that you are relieved of excess liquids!) Basic needs are pens/pencils, at least one clipboard for the navigator and hopefully another mounted for the driver to use "hands free" - (more on this later), a simple four-function calculator (unless expressly prohibited to adhere to true "historic" conditions), and a time-keeping device that can be set to match the rally master's clock. Currently, most rallies are timed to the one-hundredth of a minute instead of seconds. This makes it easier to score the rallies. Unfortunately, unless you have clock or watch that keeps time in hundredths (and most of us don't), a good thing to have is a sheet of paper with a table that converts seconds to hundredths and vice-versa (1 second = .016, 2 seconds = .033, 3 seconds = .05, 15 seconds = .25, etc.) Decide who is going to do what - on-course arguments never add to the fun, and divorce lawyers are rarely present at the finish. Plan to work as a team and divide the duties. Ideally, for "stock" (or historic) class rallies, the navigator should be able to devote the majority of his attention on keeping track of where you are "time-wise", this means that he'll be spending a lot of "heads down" time with the calculator and pencil (Dramamine often becomes a necessity). That

continued on page 8



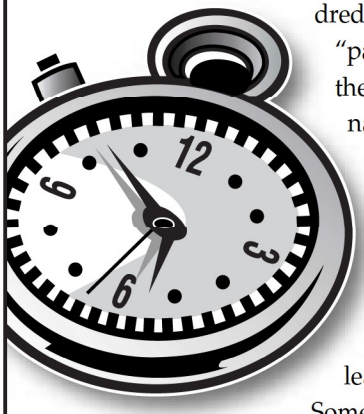
continued from page 7

Basic TSD "Stock" Rallying

also means that the driver will need a set of route instructions placed somewhere where he can glance at them to follow the course. Often a clipboard can be placed near the center of the dash for this purpose. The majority of rally masters will supply each team with two sets of the route instructions just for this purpose. When not required to keep up with the math, the navigator should assist the driver in making sure that course following directions and speed changes are made at the proper times.

Once you are registered, you should obtain a copy of the rally's "General Instructions" (GIs). READ THEM. The GIs define the rally; what is expected, what abbreviations need defined, what specific "rules" apply (for example, oftentimes signs on the left hand side of the road are to be ignored, unless explicitly stated otherwise in the "Route Instructions" (RIs)). Now is the time to set your timepiece to match the rally master's "master clock". You will be given a car/team number. The Route Instructions will be written with all key times given for the imaginary "car zero". If "car zero" is to start the rally at 11:00 and you are car #1, you will be starting at 11:01. If "car zero" is to begin the timed portion of the rally (after the beginning odometer check) at 11:45, and you are car #21, you will begin at 12:06.

At some predetermined amount of time before each team's start time, you will be given your set(s) of route instructions. This is done so that no one team has the RIs for a longer period of time before they start than any other team. You should be given your RIs with plenty of time to review them; highlighting speed changes, possible delays (generally allowed for traffic signals, etc.), any untimed sections (free zones), etc. Highlighter markers are good for this. Be sure to note any pauses - they will be give in hundredths! - so "Pause 25" means "pause 15 seconds". Hopefully, there will be enough time for the navigator to begin to calculate the perfect times required between each instruction. Now you're ready to actually start the car and roll down the road!



Every rally begins with at least an odometer check. Sometimes a "tire warm-up" section is included before that. The purpose of these sections is to find out how close (or far off) your odometer is to the rally master's. These sections will cover 10 to 20 route instructions and a specified amount of miles (generally around 10) and you will be given plenty of time (30 to 40 minutes) to complete this. You will also be given a key time (car zero's time plus your car number) to actually begin the timed portion of the rally after completing the odo check. If allowed, many teams will leave the registration area early



and use all of their "wait time" at the end of the odo check. Be sure to zero (or note your mileage) when starting the odo run and note your ending mileage at the end of the check. Be sure to pull away from the end marker of the odo leg after you have recorded your mileage so that other teams can get their proper readings. Calculate your correction factor by dividing your actual mileage by the official mileage given on the RIs. For example, if your mileage was 8.45 and the official mileage was 8.1 miles, your correction factor is 1.043 (or 4.3%). You can use this factor now to match your odometer readings to the official mileages given on the RIs. Again, using the same example, if RI #18 says "12.8 miles, Turn Right", take 12.8 times 1.043 and you would expect to find the right turn at 13.35 miles by your odometer (as long as you haven't been off course!). Typically (but not always) your odometer and speedometer work in tandem, if your odo runs short, your speedometer runs slow too. If you know from experience that this is true for your car, using the same example correction factor of 1.043 and the RI says to travel at 35 mph; you will have to run at 36-37 mph to stay on time. Usually, since the tire warm-up and odo sections are not timed, the navigator can use this driving time to work ahead on calculating arrival times. The driver should zero the odometer and be prepared to leave the start marker at your designated time.

continued from page 8

Basic TSD "Stock" Rallying

When you start, get up to the designated speed as quickly as possible and maintain that - many a first check point is just three tenths of a mile down the road around that first blind turn!

II. Time-to-travel-distance calculations.

On a straight-forward TSD rally each RI will give the total elapsed mileage (from the last time that you were told to zero your odometer), the delta mileage (mileage since last instruction), possibly a diagram of the intersection, and an instruction (or instructions) to follow. The speed that you are to travel is either given, or assumed from the last time that you were given a speed change. For example:

RI#	MILEAGE	DELTA	NOTES	INSTRUCTION
14	10.08 0.00	.22	ETZ CAS 45	End Odo leg at "MILE 14". Zero ODO. Start section 1. Keytime 04:00.00
15	1.00	1.00	CAS 30	R at "WHITES BOG VILLAGE"
16	1.45	.45	CAS 20	R at T
17	1.92	.47		L at first side road

RI 14 tells us that we're at the end of the odo check. We note our actual mileage (10.5, for example) and calculate our correction factor (10.5 / 10.08 = 1.042). We're car #15 so our out time is 4:15. We're going to go at 45 mph when we leave (47 mph, if we use the correction factor). Using our correction factor we can calculate that we should expect to come up on the "T" intersection for RI 16 at 1.51 miles on our odo and the side road for the left hand turn for RI 17 at 2.00 miles. We can calculate the time it takes to make each turn by using the formula (Distance X 60) / speed = minutes. So the first mile for instruction #15, at 45 mph will take 1.33 minutes (add that to our start time of 4:15 to get 4:16.33), .45 miles for RI #16 at 30 mph = .90 minutes (4:17.23), .47 miles for RI #17 at 20 mph = 1.41 minutes (4:18.64 or 4:18:38 seconds). On RI 18 (not shown) we'd still be traveling 20 mph.

If a "pause" is included at any point, just add that in to your calculations. Remember, pauses are included to allow you time to get safely through a special situation, such as a traffic signal. If the light is green when you reach it and you can go right through, and you've been running on time, the driver may need to pull over and actually pause; if it takes you longer to get through the light than is allowed, you may have to run at a higher speed to get "back on time". Regardless, you always add in the noted pause time to your calculations.

Sometimes the rallymaster will throw in a DIYC - "do it yourself checkpoint". You are to calculate when you should have arrived there (since it will be marked in the instructions you can actually drive faster and get there early). Do this by using the calculations above for all of the RI's from the leg start to the ending point and add the total time to your start time for the leg. Remember to add in any noted pauses (and be sure to do that in hundredths). Usually your out-time from a DIYC will be some amount of minutes added to your calculated arrival time.



Now you know how to calculate your perfect time through a straight-forward TSD rally. Since they've been presented in the same format, following the actual driving directions should not be a problem for those of you that have been running LANCO's "Poker Runs"; now you're just adding in the timing calculations to achieve a lower score. All it takes from here is practice; and a rally master who is not too sadistic! The first time you'll get frustrated, but like good wine, you'll get better with age.

TIPS FOR NOVICE TSD RALLYISTS *by Gary Starr (rev 3 –3/15/2018)*

For TSD Rally Navigators:

1) **Stay on course first!**

a) It is meaningless to keep time on the wrong road.

b) Help your driver with course following. Four eyes are always better than two and it is to your advantage to stay on course also - if you don't believe this just think of the mess you will have with an off course timing exercise.

c) Take as much time as necessary to figure out an intersection (eg. trap intersection on a course event) even if you must go down a minute - remember taking a time allowance is nearly always free. That is how you will learn and you will be amazed at how much faster you can figure out those types of intersections in the future. Remember this also (while you are stopped using up time to figure out the course): The only place you must be on time is at the control.

2) **Keep a log:**

a) Write on the log only information needed to reconstruct the leg should you go off course (i.e. out time, CAST, speed change mileage, pauses). Do not write on the log calculations for periodic time checks or mileage turns.

b) Keep the log simple and neat. Use scratch paper (or a special area on the log sheet) for miscellaneous calculations that do not belong on the log (e.g. periodic time checks, corrected mileage for turns, etc.).

c) Many apps have their own log in which case it will keep one for you.

3) **Timekeeping:**

a) The best/easiest thing is to use one of the new TSD rally Apps on your mobile device which also has GPS mileage and a real time clock (see list at end of this article). Or if you just need an accurate hundredths of a minute clock/watch you can use the CentWatch App for an iPhone, iPad, or iPod. Note you can also use your wrist watch for TOD out times (and start a leg watch from it) as these watches are highly accurate. Whatever you use for timekeeping, have a cheat sheet handy that summarizes how to use your method (what to do, when, and how) for when under pressure you get all flustered and can't remember any of it. Pick a 10 mile road, make up some instructions with speed changes, pauses, controls and go out and practice your timekeeping method weeks before the rally (don't wait until the day before)!!! Also make sure you practice both an off course excursion with timekeeping recovery and how to handle Time Allowances (personal

delays) with your timekeeping system. It WILL happen sooner or later so practice how to handle it now.

Note that a TA (Time Allowance) slip must be on the ½ minute [eg. 0.50 min, 1.50 min, etc (or 30 seconds, 1:30, etc)]. This is so you don't arrive at the control line exactly at the same second as another rally car who didn't use a TA. Be careful, however, to not get mixed up if you take more than one TA on the same leg. Since the first must be on a ½ minute, subsequent ones on the same leg must be on whole minutes so the resultant TA you hand in ends up being on the ½ minute. Example: first is 0.50 minutes and next is 4.00 minutes, so 0.50 + 4.00 = 4.50. It's very easy to make the mistake out on the course of using 4.50 minutes as the second one (since you're thinking TA's must be on ½ minute intervals). Then 0.50 + 4.50 = 5.00 and you just gave yourself 50 points (since that's not on a ½ minute)!

b) If your method/class requires distance information to be manually entered/incremented into calculating equipment (eg. SCCA class S or L), select an easy increment of mileage to do periodic time checks at (eg. every 1/2 mile or mile from the last speed change or control – and every 0.1 mile or less when approaching a control). Note: In 2018 SCCA changed class L to also allow any electronic app if the distance information is derived solely from GPS signals. With these "distance derived from GPS" apps, you no longer have to enter/increment any distance and they can even automatically display how early/late you are.

c) When you're not trying to run exactly on time (eg. control is not imminent, in a free zone, etc), round off hundredths on time checks to make it easier. Your driver doesn't care in that situation if he's up 57 or 63 - just say up 60. When controls are imminent then you need to be exact.

d) <u>If you know between which 2 instructions the control is, but not where</u> (no control mileage), run minutes early to the instruction before the control and stop. Then leave that point at the proper time (which you compute from the official mileage of that instruction, or your odo mileage if you have no official mileage there) and drive the CAST to the control. Note if the instruction is mileaged, you can figure all these out right after you receive the routes. Running those minutes early will allow you to slow down to take very twisty places at slow enough speeds so you won't risk going off the road (like in winter) as well as get by congested areas or unexpected things that take up time.

e) <u>If you know the mileage at the control</u> there's a very clever and easy way to get good scores. Run minutes early to 0.5 mile before control and stop. Compute perfect control in-time from control mileage and subtract 1 minute. At that time, CAST 30 MPH all the way to the control. [30 MPH is 2 minutes/mile so going 0.5 mile should take 1 minute - which is when you leave your "stand-off" point (stand-off point is 0.5 mile before control)]. So going 30 MPH will not only make you arrive exactly on time but will also be slow enough to get you around twisty curves.

f) If you don't know where the control is then you are going to have to run on-time all the time where controls may be (and run early where controls can never be, like free zones, transits, odo check, and breaks). But use common sense. Don't ever drive so fast that you will go off the road. Going off the road and getting stuck (or worse) is FAR worse than getting a late penalty. And if the rules allow delays or a TA (Time Allowance) which nearly all rallies do, use them rather than driving too fast and risk going off the road. Also many R/M's purposely give you extremely twisty roads that you can't possibly keep up the CAST on just so you can enjoy them - then they give you a couple miles of straight after it so you can make up the time. Again, if in a free zone or transit, run early to cover these situations.

g) At breaks the first thing you need to do, before even getting out of the car, is figure out when to leave the break area to make it to the restart (and how far away the restart is). During break, both driver and navigator should keep an eye on the time but it is primarily the navigator's job. Refuel before going to break if needed.

4) **Control procedures:**

a) Split your TOD watch at the inline. If the driver has to get out to go to the control car for the timing slip, give him the TOD in-time before he gets out. In-times are sometimes misread (or mixed up with another car's) and this will save valuable time if there is a discrepancy. Even if you don't have to leave the car, the in-time should be the first thing you check on the timing slip. Also write down your in-line odo reading on the critique or timing slip next to the official leg mileage.

b) Immediately start preparations for the next leg: resetting odo's, watches, log, etc. You may not have much time when your driver gets back or when you arrive at the outmarker.

c) Read everything on the critique or timing slip. Often there is info that you'll need on the next leg such as a new Cast, outmarker location, instruction working on, special instructions, etc.

5) **Miscellaneous:**

a) Have a "rally bag" that you keep everything in (eg. 6-8 pencils, pens, 5 highlighter colors, sticky labels, paper, small scissors, routes centerboard, navigator clipboard, any unique mobile devices and GPS receivers for rallying, backup calculator (that has a working battery for night events), small light, duct tape, regular tape, bungee cords, Dramamine, Tums, etc). When you return home from the rally, immediately sharpen pencils and organize everything in the rally bag so it is all ready for the next event. Then all you have to do the day of the event is grab it and go as you know everything is already there!

TSD Rally Timekeeping equipment available:

Apple devices:

- App: "CentWatch" hundredths watch for iPhone, iPad, iPod - free
  https://itunes.apple.com/us/app/centwatch/id424471807?mt=8
- App: "RallyOdoTimer" GPS twin odos for iPhone, iPad - free (C. Westberg)
  https://www.appannie.com/apps/ios/app/rallyodotimer/#
- App: "Richta" for iPhone, iPad, iPod - $10 (David Bireta)
  iTunes App Store
- App: "Richta Rally Calculator" for iPhone, iPad, iPod, Android - $10 (Rich Bireta)
  https://play.google.com/store/apps/details?id=com.Richta.Calculator&hl=en
- App: "Richta Rally Checkpoint clock" for iPhone, iPad - $1 (Rich Bireta)
  https://itunes.apple.com/us/app/checkpoint-clock/id549741037?mt=8
- App: "GPS Rally Odometer" for iPhone, iPad - $8 (Michael Young)
  http://www.msyapps.com/apps/gps.html
- App: "GPS Rally Computer - SRC" (class L) for iPhone, iPad - $10 (Michael Young)
  http://www.msyapps.com/apps/gpscomp.html
- App: "TSD Rally Computer" for iPad - $28 (Michael Young)
  http://www.msyapps.com/apps/rallycalc.html#sthash.PpkGZoou.dpuf
- All Rally apps by Michael Young
  http://www.msyapps.com/

Android devices:

- App: "Richta Rally Calculator" for iPhone, iPad, iPod, Android - $10 (Rich Bireta)
  https://play.google.com/store/apps/details?id=com.Richta.Calculator&hl=en
- App: "Richta TSD Rally Calculator Full Version" for Android - $10 (Rich Bireta)
  https://www.amazon.com/Richta-Rally-Calculator-Full-Version/dp/B006SPMMIY
- App: "Richta Rally Checkpoint clock" for Android - $1 (Rich Bireta)
  https://play.google.com/store/apps/details?id=com.Richta.CheckpointClock&hl=en
- App: "Richta Rally Computer" for Android - $20 (Rich Bireta)
  https://play.google.com/store/apps/details?id=com.Richta.Computer&hl=en
- App: "Richta Simple Rally Computer" (class L) for Android - $6 (Rich Bireta)
  https://play.google.com/store/apps/details?id=com.richta.simplerallycomputer
- App: "Richta Rally Odometer" for Android - $5 (Rich Bireta)
  https://play.google.com/store/apps/details?id=com.Richta.Odometer
- All Rally apps by Rich Bireta
  https://play.google.com/store/apps/developer?id=Rich%20Bireta&hl=en
- Rabbit Regularity Rally (TSD) for Android – free but only in seconds
  https://play.google.com/store/apps/details?id=com.rabbit.nav&hl=en

Other devices:

- "TSD Rally Runner" Tablet + GPS computer (scca class E/L) - $200
  http://www.3peakengineering.com/motorsport/rally-computers/tsd-rally-runner/
- Dual "external Bluetooth GPS receiver" for Apple and Android devices
  http://gps.dualav.com/explore-by-lifestyle/car/
- Garmin Glo "external Bluetooth GPS receiver" for Apple and Android devices
  https://buy.garmin.com/en-US/US/shop-by-accessories/sensors/glo-/prod109827.html

- Spark Electronics "GPS speed sensor" (pulse generator from GPS)
  http://www.rallycomputer.com/speed-sensors/gps-pulse-generator.html
- Centrodyne Vehicle Speed Sensor (VSS) signal products
  http://store.centrodyne.com/store/Vehicle-Speed-Signal-Products-C11.aspx
- Belmog rally instruments, clocks, sensors, accessories (Belgium)
  http://www.belmog.com/index.php?route=product/category&path=59_111
- Fastime 500DM decimal minute stopwatch
  http://www.astopwatch.com/products/index.asp?product=fastime-500dm-16-491
- Timewise Computers (this is the undisputed ultimate scca class E or L equipment – pricey)
  http://www.timewise.us/
- Alfa (scca class E or L equipment - nowhere near quality of Timewise but way cheaper)
  http://www.rally.cc/
- Brantz Rallymeters – hugely popular rally equipment in the U.K.
  https://www.brantz.co.uk/

Old and obsolete equipment:

- "EZ Rally Timing" article (scca class S) using 4 function calculator (G. Starr):
  See eztiming.pdf here: https://www.facebook.com/groups/twincityrallyclub/files/
- Stevens Rally Indicator (rally circular slide rule for time calculations):
  http://sliderules.nl/mysliderules/detail/stevens-rally-indicator-model-25
- Halda products:
  http://www.haldaman.com/
- Guide to old rally equipment:
  http://www.specialstage.com/forums/archive/index.php/t-18082.html
- Manuals for various older rally equipment:
  http://www.rallyracingnews.com/manuals/index.html
- "The Road Rally Handbook" by Clint Goss, available in library ISBN 0-9632401-0-2:
  Can be seen here: http://www.goss.com/catrrh.htm
- "Rallying to Win" by Jean Calvin, available in library ISBN 0393600025:
  Can be seen here: https://www.amazon.com/Rallying-Win-Complete-Guide-American/dp/0393600025

For TSD Rally Drivers:

1) On TSD road rallies have the routes used for course following on the dash between driver and navigator so both can see them (so both can double check they are executed correctly and write any notes on them). I see many teams have them on the navigators lap which is the worst place - driver can't see them - what if navigator reads them wrong which WILL happen sometime? Also navigator is busy doing timekeeping. {This is not to say the navigator might not have his own set of routes in his lap to keep track of mileage error – just keep the main set used for course following on the dash where both can see them.} Use a clipboard or 1/4" plexiglass centerboard bungie corded to the dash defrost vents to hold the board. And for night events have a light mounted on the board. I also have popsicle sticks with Velcro on the back for main road determinants (for course rally) on my route board which work great. But use common sense. Obviously if you're on a brisk event where it's too dangerous for the driver to look down at the routes, then they need to be on the navigator's lap with him calling them out.

2) Drivers check off the route instructions yourself (not the navigator) to help you pay attention and not make mistakes (but navigator should watch to make sure the proper instruction is being worked on).

3) Highlight in different colors on the routes: speed changes, pauses, restarts, free zones, transit zones, quoted signs, onto's (if course rally).

4) On course rallies circle the onto's when they become active, X them off when you lose them.

5) Never go past the leading edge of an intersection that you're not sure of (eg. especially on a course rally) - always make sure you slow down enough to accomplish this - stop if necessary before the intersection, not in or past it. The biggest mistake and waste of time beginners do is driving through intersections and having to back up. This will take 5 times longer to do than if you had stopped before the intersection (not to mention very dangerous).

6) Remind your navigator during the leg when a speed change is about to be done - a smart navigator will appreciate this. Inform your navigator what you are thinking about the course and/or traps and when you are going to turn around. Call out loud where you are going and why at every intersection where you are doing an instruction or following the main road, so your navigator can follow your logic (e.g. " I'm following the main road Left at T" or "Main road is right by Protection so I'm going to do the instruction Left"). This will give your navigator the chance to disagree and save you an embarrassing backup or max. - remember you're a team and need to check each other - the smart driver knows this all too well!!! On course rallies call out all curve arrows (either partner) whether the curve arrow determinant is active or not [e.g. "Curve arrow right" or "Curve arrow doesn't count". This will help when you get to the intersection and see the back of a diamond shaped sign in your mirror (oh sh..) but then you remember your partner called it out so you don't have to go back - aren't navigators great who don't keep their heads down?].

7) Always bring to every rally: a wrist watch to synchronize with WWV or to the rally master clock (needed at breaks), any rally mileage/timekeeping equipment, GPS, pencils, centerboard, navigator clip board/lapboard, compass, a full size spare, interior lights if night event, and if a winter snow rally: real snow tires (not all-season), shovel, triangle/flares, 6V lantern, tow strap, x-bar lug wrench, extra warm clothes & mittens & boots. Disconnect passenger air bag if you have an object (eg. rally computer or centerboard) in front of it so it won't get blown into the navigator's face should it go off (my car has a connector just inside the glove box).

8) Go to the end of free zones ASAP without speeding or stopping. There's a reason they are free and you may get delayed in them.

9) Leave breaks and begin odo check early (at least 10 minutes minimum - there's ALWAYS something that you'll need extra time for). A restart point may be many miles away from the break which you also need to account for (look where it is in the routes before leaving car for break and know your restart time and distance). You also may get delayed on the way to the restart (traffic, accidents, etc). And re-fuel BEFORE you stop for your break. At lunch break don't order food that will take longer to get and eat than you have time for (eg. restaurant is crowded so food orders will take too long to even get the food, etc).

10) When you get to the control crew after the timing line, the first thing you do is verify the in-time they give you. Sometimes it's for another car or off by a minute. You don't want to have to go back to straighten it out. Draw a line across the routes where the control was along with control number. Record your mileage next to the OM on the critique/timing slip along with any delay/TA taken.

11) Get to the outmarker (or Begin Control Zone) quickly and setup (ie. don't hang around the control crew talking or drive too slowly on the way there). Sometimes it's miles away and you may not make your out time. Also occasionally finding the outmarker can be a problem so it's wise to note and measure the distance.

12) At outmarker:

a) Double check that your navigator has got things setup properly. He will thank you if they aren't and you sure don't want to mess up the leg before you've even started!

b) On course rallies, read the critique (description) of the leg to make sure you did it right for the same reasoning as the rallymaster intended before starting next leg. Precedence is set by the rallymaster, not you (and you may need this knowledge on later legs).

c) Driver fills out the scorecard while navigator is setting up next leg - the navigators got enough to do. This should be the last thing you do however, and ONLY if you have time (you can always fill it out at the end).

Downloaded from RReNews 1803 - #comeroadrally