The purpose of this document is to help the adult who has volunteered to counsel Boy Scouts in one of more of the four Nova Awards. There are great references available from the BSA, but at the current time they don't serve as a syllabus that someone can easily pick up and run with. This teaching guide is structured so it is compatible with the Patrol Method and a Troop Plan. It is meant to help an adult and their assistant explain, demonstrate, guide, and enable a patrol-sized (5 – 8) group of Boy Scouts through the requirements of Nova awards: What resources to review first, how to present the material, what supplies are needed, what cost is involved, what kind of time it should take, how to document completion, and how to ensure Scouts are recognized right for their achievements. This document is to be kept by the Troop Librarian.

"NOVA" WITHIN BSA STEM

Area	Nova Name	Activity
Science	Shoot!	Catapult/Coaster/Pitch
Technology	Start Your Engines!	A working vehicle
Engineering	Whoosh!	Visit Amusement Park
Math	Designed To Crunch!	Collect Sports Stats

The BSA recognizes that there is boundless opportunity and necessary need for youth to be exposed to, and hopefully pursue, lifelong interests in Science, Technology, Engineering and Mathematics (STEM). As one part of a comprehensive strategy to assist in this area, the BSA created a complementary set of four awards that Scouts could earn; the set of those awards is called Nova. Each of the Nova awards concentrates on one of the four domains of STEM.

CAUTION: Because the capabilities of boys change with their maturity, the BSA Nova awards are further separated by type of Scout (i.e., age): Cub, Boy Scout, and Venture Crew. Be sure that you are reviewing the right requirements and grabbing the right patches[1]—they go by different names, and you can't mix and match: for example, a Cub Scout with three Nova awards can't earn one Boy Scout Nova award and be considered "complete."

In the BSA STEM program, adults who meet and adhere to Youth Protection Certification/Guidelines[2] counsel[3] Scouts through each Nova Badge. After all the Nova badges are earned for a given level of

[1] Nova Award patches are color coded by program: Blue for Cub Scouts, Red for Boy Scouts, Green for Venture Crew [coming soon]. Nova patches and pins are available from your local Scout Shop; check with the unit advancement chair. The first award is the patch; the next three awards are pins that affix to the E / S / W points.

[2] The Boy Scouts of America requires that counselors and mentors take BSA Youth Protection training annually. This program addresses strategies for personal safety awareness for youth as well as adults. BSA Youth Protection policies include

- Two-deep leadership
- No one-on-one contact
- Respecting privacy
- Reporting problems

The BSA Youth Protection guidelines have been adopted primarily for the protection of our youth members; however, they also serve to protect our adult volunteers and leaders from false accusations of abuse. BSA Youth Protection training is available online at http://myscouting.scouting.org .

[3] A Nova counselor can be any registered adult age 21 or older. Parents and unit leaders may be Counselors with little or no STEM background. They will guide the Scout in researching topics of interest and completion of the activity requirements. Youth Protection Guidelines must be met (no 1 on 1 contact). Counselors must register annually with position code 51, no charge, not a unit leader position.

Scouting, interested Scouts can continue on to earn "SuperNova Awards[4]." Adults don't counsel these awards, but instead mentor[5]. The SuperNova awards are kind of like the Eagle Scout rank of STEM (at least until the BSA's new STEM Scout program fully launches!).

THE BSA WAY

The BSA has three aims for Boy Scouting: Character Development, Citizenship Training, and Personal Fitness. Every activity in Scouting needs to be conducted in a way that supports these overarching objectives of how Scouting transforms youth into young men. But Scouting doesn't just stop there; it has eight methods it requires to be used in order to reach these master objectives:

Ideals: The benchmarks Scouts pledge to (and measure themselves against) in the Scout Oath, Scout Law, Scout Motto, and Scout Slogan.

Patrols: Scouts live in small groups, with responsibilities that help them relate to each other.

Outdoor Programs: Scout skills come alive with use in the field, where Scouts gain an appreciation for how to use what they have learned and why they need to master it.

Advancement: Scouts surmount obstacles that challenge them, and are rewarded for it—right away, but also formally in front of the whole. This gives them self-reliance and an ability to help others. Parents, remember: *Advancement is a means to an end, not the end in itself*!

Association with Adults: Scout leaders (Scouters) are positive role models that Scouts become. Scouters show a sincere interest in the Scouts by first listening to them, then encouraging and guiding them to success via well-asked questions. Adults should not do what a Scout can.

Personal Growth: Scouts plan their activities, and make progress towards their goals. They do Good Turns for others. The ScoutMaster conferences with each Scout to review how they are achieving Scouting's Aims.

Leadership Development: Scouts learn to lead by doing, and accept and support troop leaders.

Uniform: Boy Scouting is an Action program, and wearing the uniform shows each Scout's commitment to the aims of Scouting while also serving as a visible testimony and positive youth image in the community. The Scout Uniform gives identity within the larger brotherhood of youth who share the same ideals. The Scout Uniform enables the Scout to display their personal heritage of activities and accomplishments.

[4] Supernova Awards are medallions on ribbons to be worn around the neck. Each are specific to the Supernova Award earned. Supernova Awards are controlled items and must be ordered from BSA National upon approval of the Supernova Award Application. This document doesn't delve into these awards.

[5] Supernova mentors must be 21 or older and be subject matter experts in a STEM (science, technology, engineering, mathematics) field and are willing to share accumulated wisdom and experience with Scouts. The Mentor will supervise more extensive research and learning activities over a longer time. A parent or guardian is not permitted to mentor their Scout. Youth Protection Guidelines must be met (no 1 on 1 contact). Mentors must register annually with position code 52, no charge, not a unit leader position.

WHAT IS A NOVA COUNSELOR?[6]

What Scouts can expect: *Fun with a purpose!*

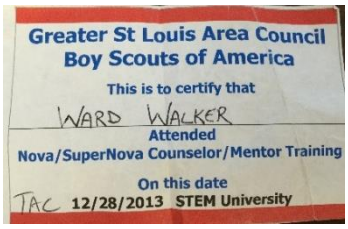
1. Watch TV and/or Read about the subject for 3 hours
2. Complete one merit badge from a list
3. Talk with a Nova counselor about how it all fits together in some scenarios
4. Build, Test, and Explain a special project
5. Talk with your Nova counsellor about how this impacts your life

Do Novas in any order.
Get the [*Red*! BSA] Badge with the first one, "Pi's" with the last three.

A Nova counselor and Supernova mentor are both teachers and mentors to the Scout as they work on the Nova or Supernova award. A Nova Counselor need not be a specialist in STEM topics, but is willing to work with Scouts to facilitate their exploration and learning of the technical topics and completion of projects. A Supernova mentor is very much like a merit badge counselor for Boy Scouts but specializing in STEM topics in greater depth than in merit badges, activity pins, or belt loops and for all levels of Scouting. Nova counselors and Supernova mentors should be satisfied that each Scout under their guidance meets all the requirements set forth for the award. In this sense, a counselor or mentor is an examiner. In a larger sense, the real opportunity for a counselor/mentor lies in coaching— helping Scouts over the different hurdles of the requirements and helping make them aware of the deeper aspects of the subject from their knowledge and experience. The Supernova mentor leads the Scout to learn by research and doing. The mentor may help a Scout by providing instruction and more in-depth guidance on the subject matter. However, the counselor or mentor must not complete the Scout's work on the requirements. The counselor or mentor must test the Scout to ensure that the work is completed to meet the requirements but may not modify the award requirements in the process. This standard ensures that the advancement requirements are fair and uniform for all Scouts[7].

A counselor or mentor must always ensure that a Scout has a "buddy" present at all instruction sessions. Working on awards is especially enjoyable when Scouts work together, and the BSA encourages this by making the buddy system a part of the advancement program. Together the two meet with counselors or mentors, plan projects, and keep their enthusiasm high. The Scout's buddy could be another Scout, a parent or guardian, brother or sister, relative, or friend. The Scout should bring a buddy to all his appointments with his counselor or mentor.

Counselors and mentors may also serve as Cub leaders working with STEM related belt loops and pins, Boy Scout STEM merit badge counselors, and Venture advisors working with the STEM Explorations. To register with the Boy Scouts of America, a potential counselor or mentor must complete the BSA's Adult Application form (No. 28-501Y; available in Spanish as No. 28-502S) and submit it along with the BSA Supernova Awards Mentor Information form (No. 514-017) to the BSA local council office. Renewal of this registration and youth protection training annually is necessary to continue as a mentor. There is no requirement for it, but some Councils will provide STEM Counselor / Mentor training.


Greater St Louis Area Council
Boy Scouts of America
This is to certify that
WARD WALKER
Attended
Nova/SuperNova Counselor/Mentor Training
On this date
TAC 12/28/2013 STEM University

CAUTION: There are a couple challenges with the BSA's NOVA Awards; they don't have a built-in tracking / communication system for advancement purposes like Merit Badges have with Blue Cards or Ranks have with the Scout's Handbook; unlike the Ranks and Merit Badges which have a permanent

[6] The remainder of this overview cites in part the wonderful STEM work of the Greater Alabama Council of the BSA (https://1bsa.org/nova-program.php). As a general concept in Scouting, "get Googley"—there are probably wonderful wheels just a click away that you don't have to reinvent!

[7] Scouting is a Program of Opportunities! If you are working with a Scout with disabilities, ensure you are familiar with "Scouting for Youth With Disabilities" (http://www.scouting.org/filestore/pdf/34059.pdf), and discuss your accommodation concepts first with the ScoutMaster and unit Advancement Chair.

place on the Scout Uniform for display, the Nova Awards compete with activity badges for space on the right pocket-button; and unlike Merit Badges, which have a MB Counsellor form, there isn't an official form: see the next page for one you can use:

Nova Counselor Checklist

Thank you for your interest in being a Nova Counselor. To ensure you are properly prepared, please complete this checklist and send to the Council Office.

Contact Information:

Name		Email Address	
Address		Phone Number	
District		Unit	

This information will be used by Scouts to contact you for Counseling sessions and by the Council to provide you updated program information.

Checklist:

Select the Nova Award(s) that you will Counsel. See the requirements at www.scouting.org/stem/Awards.aspx

	Science	Technology	Engineering	Mathematics
Cub Scouts and Webelos	☐ Science Everywhere	☐ Tech Talk	☐ Swing!	☐ 1-2-3 Go!
Boy Scouts and Varsity Scouts	☐ Shoot!	☐ Start Your Engines	☐ Whoosh!	☐ Designed to Crunch
Venturer Scouts	☐ Launch!	☐ Power Up	☐ Hang On!	☐ Numbers Don't Lie

Specify for whom you will be a Counselor.	☐ Anyone who requests ☐ Just unit(s) _____
Complete Youth Protection Training (at least every two years)	Online at www.scouting.org/Training/Adult.aspx Completion Date _____
Register as a Nova Counselor (no fee, use registration code 51, reregister each year)	Completion Date _____
Complete Nova Counselor Training (optional, but recommended)	Completion Date _____
When completed, please send this checklist information to the council service center. You will be added to the list of Nova Counselors. All earned Nova Awards must be approved by a registered Nova Counselor.	

BOY SCOUTS OF AMERICA®

Prepared. For Life.℠

Figure 1 Form is Courtesy of the Greater Alabama Council

TIPS FOR COUNSELING SCOUTS

Getting an audience is hard. Sustaining an audience is hard. It demands a consistency of thought, of purpose, and of action over a long period of time.
Bruce Springsteen

Know your audience! Scouts are not adults; they are badly allergic to Lecture Halls. Plan your counseling process in a way that co-opts the Methods of Scouting, that interrupts the Journey with Vignettes, that is constantly changing up it's approach so the Scout must remain engaged. The Scout's Handbook (Page 53?) outlines a proven technic called "The Teaching EDGE," and this should be part of your toolkit…even better, adapt your counseling process in a way that requires the Scouts to "run in"—see the Leading Edge in the Scout's Handbook for more on this concept (page 59?).

Where the group is:		What a Trainer can do
Forming	Starting out— Skills are low; Enthusiasm high	Explain
Storming	Becoming discouraged— Skills and enthusiasm are low	Demonstrate
Norming	Making progress— Skills and enthusiasm are rising	Guide
Performing	Finding success— Skills and enthusiasm are high	Enable

THE NOVA AWARD PROCESS

The requirements for each Nova and Supernova award appear in the current BSA Nova Award guidebooks for the Cub Scout and Webelos, Boy Scout, and Venture programs, and in the current edition of the Boy Scout Requirements book, available at Scout shops and council service centers. The requirements are also available at http://www.scouting.org/stem .

When a Scout has decided on a Nova award to earn, the Scout obtains from the Scout Leader the name and phone number of the unit-approved Nova award counselor. When a Scout has selected a Supernova award to explore, the Scout obtains from the Scout Leader the name and phone number of the district/council-approved Supernova mentor. At this time, there is no Application for Nova/Supernova Award (blue card), but Scout Leaders should counsel the Scout to ensure readiness to begin the award. Applications for Nova and Supernova awards can be found at http://www.scouting.org/stem .

The Scout contacts the counselor or mentor to make an appointment, and together they schedule a date and time for the Scout and buddy to meet. The counselor suggests that the Scout bring the Nova guidebook and any work begun or accomplished, and that the Scout prepare by reviewing the requirements.

At their first meeting, the counselor or mentor and the Scout decide upon a tentative schedule for completing the requirements. They should keep the Scout's other obligations (Scouting, school, worship, etc.) in mind, and set the dates, times, and locations for future meetings. The counselor or mentor will explain the requirements for the badge and help the Scout plan ways to fulfill these requirements so that the experience is most rewarding.

Nova counselors and Supernova mentors help Scouts meet the requirements for award. They should expand on the information in the Nova guidebook based on their knowledge, experience, and expertise in the subject and the interests of the Scout. They are encouraged to tell about their own experiences that positively reinforce the subject matter, but new requirements or additional work may not be added. The Scout is expected to meet the requirements for the award as stated—no more and no less.

The number of counseling sessions will depend on the difficulty of the award requirements and the Scout's preparation and ability. Nova awards may be earned in only a few visits, but Supernova awards

are expected to be more difficult and require more time and work from the Scout and support from the mentor. The Scout and counselor or mentor are expected to meet as many times as is necessary for the Scout to complete the requirements. The advancement program allows Scouts to move ahead in their own way and at their own pace. The rate of advancement depends upon the Scout's motivation, interest, effort, and ability.

As the Scout completes each requirement, he is always tested (but with a buddy present), and as each requirement is completed, the counselor or mentor marks it in the guidebook. When all the requirements for the award are fulfilled, the counselor certifies that the Scout has completed the requirements. The Scout may return his annotated Nova guidebook to his Scout Leader. The unit then completes an advancement report form and picks up the award from the scout shop, just like all other awards. The last requirement of Supernova Awards is to complete an award application and submit it to the BSA National Office for approval.

Requirement	Nova Counselors	Supernova Mentors
Register annually with the Boy Scouts of America. (no charge, not a unit-level position)	Yes; use Counselor position code 51	Yes; use Mentor position code 52
Be at least 21 years old	Yes	Yes
Be of good character	Yes	Yes
Youth Protection Training	2-Year training is current	2-Year training is current
Be knowledgeable in the award subject by vocation, avocation, or special training	Familiar, can research unfamiliar topics	Subject Matter Expert
Be able to work with Scout-age youth	Yes	Yes
Submit Application	Informal Counselor Application	SuperNova Mentor Application
Be approved by District and Council Advancement Committees	Local units may approve counselors	Yes

Remember that the Scout may be a boy or girl from Cub Scout age through Venture Scout age. They will have diverse preparation and learning styles. As a counselor or mentor, you must adapt your approach to their capabilities and interests.

The most productive environment for the Scout meeting with his or her counselor or mentor will be one in which he or she feels welcome and relaxed. Start the conversation by finding out what the Scout already knows about the subject, then stimulate interest by showing something related to it. (Be careful not to overwhelm the Scouts—remember, they are probably beginners.) Establish an atmosphere that encourages the Scout to ask questions and to ask for help when needed.

Spend some time helping the Scout learn the requirements, making sure how to complete the requirements are completely understood, whether "show" or "demonstrate," "make," "list," "discuss," or "collect, identify, and label." Take a genuine interest in her projects, and encourage her to complete them.

Remember that the requirements must be completed exactly as presented—do not expand any requirement. However, the Scout may choose to explore some topics more deeply. The Nova counselor can encourage explorations but not change the requirements. The Supernova mentor will likely offer ideas for deeper study, but this should not change or increase the award requirements.

Encourage the Scout to practice for his review session and to reflect on his accomplishments. The review process might be approached by the Scout with some apprehension. He is familiar with final exams in school and may see this meeting with the counselor as another such experience. The counselor can help by talking to him rather than grilling or examining him— there's a big difference, yet it still will be

evident what he knows. Expressing honest enthusiasm for the things he has done will give the Scout confidence.

During testing, the counselor or mentor may find that the Scout needs help learning a particular area. The counselor teaches the needed skill or helps the Scout find the information through research (internet, asking experts, etc.), and then retests to ensure the requirements have been accomplished.

Fast Facts for the Counselor and Mentor

▪ A Nova counselor may counsel any Scout, including his own daughter or son—although this is discouraged in order to offer a Scout the chance to meet a diverse group of outstanding adults. Supernova mentors may NOT be the parent or unit leader of their son or daughter unless the Scout is in a group of participants.

▪ A counselor may also serve as a mentor, if approved by the council.

▪ There is no limit on the number of Nova and Supernova awards that a counselor or mentor may counsel with one Scout. However, the Scout will benefit the most from working with a variety of outstanding adults.

▪ A counselor or mentor may limit his or her services to one unit. Mentors still must be approved by the council advancement committee.

▪ Cub Masters, Scoutmasters, and Venture Crew Advisors are not automatically approved as Supernova mentors. They may be Nova counselors if the position does not adversely impact their leadership role.

▪ Group instruction is acceptable, but each Scout must be tested and passed individually.

▪ There is no time limit for completion of awards, but awards may have rank or program requirements.

Summer Camp Nova Counselors

▪ The same qualifications and rules for apply to counselors for council summer camp Nova programs. All counselors must be 18 years or older, but qualified camp staff members under age 18 may assist the counselor with instruction. (These assistants are not qualified to certify the Scout's completion of an award.) As always, each counselor must maintain the exact standards as outlined in the award requirements—nothing deleted, nothing added.

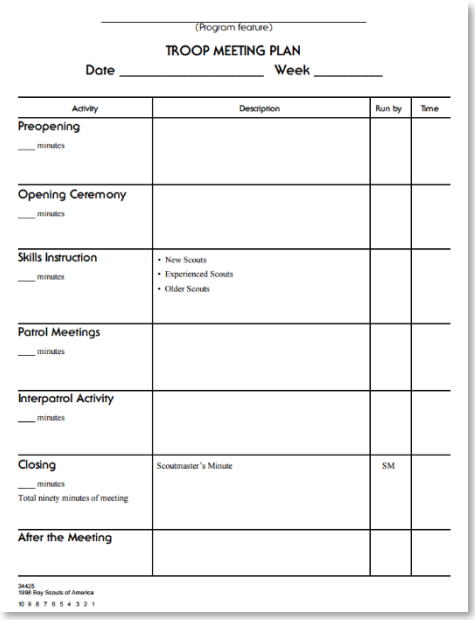
▪ Partial completion of awards at summer camp should be credited to a Scout by annotation in the Nova guidebook and given to his Scout Leader at the end of the week. For more information, see http://www.scouting.org/stem/Council/Camp.aspx

A CAUTION IN GROUP COUNSELING

Be careful that each youth demonstrates completion of each requirement. Many elements of the Nova Awards are ideal for group activities, especially visits to STEM destinations and participation in hands-on activities. However, each youth must demonstrate completion of each requirement, independent of the other youth in the unit. There are many ways in which group activities derail this intent, so special care must be taken to ensure that each youth has the opportunity to demonstrate his/her own thoughts, work, efforts, and so on. For example, many requirements include the directive "discuss with your Nova Counselor". This means that EACH youth must have a discussion with a Nova Counselor. A group discussion is not okay, because often one kid dominates, the shy kids don't participate, and any kid who speaks up after the first can essentially say, "I agree with Scout A." As another example, some requirements ask the youth to build or design a widget. Again, EACH youth must build or design his/her own widget. If a group of 4 Scouts works together to build a single widget, that does not qualify the 4 Scouts to each have that requirement checked off.

PICKING THE RIGHT VENUE

In the section above, it referred to the Scout and his buddy working with the Nova counselor to schedule times to meet. Like with merit badges, the BSA preference is that advancement activities like these occur outside of the unit meetings. However, perhaps a patrol wants to accomplish something as their entire group; in that case, they may want to accomplish at least initial general work during a portion of unit meetings. This is not impossible, but too much focus on advancement within unit meetings normally results in derailing what the Troop Committee expects the ScoutMaster to accomplish through the unit meetings.



(Program feature)

TROOP MEETING PLAN

Date _____ Week _____

Activity	Description	Run by	Time
Preopening ___ minutes			
Opening Ceremony ___ minutes			
Skills Instruction ___ minutes	• New Scouts • Experienced Scouts • Older Scouts		
Patrol Meetings ___ minutes			
Interpatrol Activity ___ minutes			
Closing ___ minutes Total ninety minutes of meeting	Scoutmaster's Minute	SM	
After the Meeting			

3HA25
1998 Boy Scouts of America
10 9 8 7 6 5 4 3 2 1

Figure 2Troop Meeting Plan

In a well-run troop, the Scouts' Patrol Leaders' Council will plan, prepare, and execute unit meetings with a template much like that shown in Figure 2. A normal unit meeting will last 90 minutes. Before a meeting begins, there will be some kind of pre-opening activities—the concept is to keep early arrivals focused and productive in activities that are open-ended, interesting, and fun. This could be an opportunity for Nova-related activities, but don't expect to have a group of scouts for a set block of time, and expect some chaos as the unit brings itself together for the larger meeting. The opening ceremony is where you will have an opportunity to make a very brief announcement to attract Scout interest in what you have to offer—better make it memorable! The Skills Instruction period is unit-wide; because it is a large group setting and you will never have the same group of Scouts two weeks in a row, it isn't ideal for counseling specific advancement items (MB's, etc)—this is more oriented to "here is how to properly pack a backpack" skills. The Patrol Meeting is about a 10 minute timeblock, and this is where the heart of the Scout planning gets done for activities over the next four months. Scouts will be

discussing the roses, buds, and thorns from their last campout, getting approval for meals and activities at their coming campout, discussing meals and activities and deputizing GrubMasters/etc for the campout in two months, and finally also suggesting activities to the PLC for the campouts in three/four months…not to mention finding out where each Scout is in their advancement process and hooking them up with resources (counselors, instruction, ScoutMaster conferences, Troop Committee Boards of Review, etc) to continue progress. That is a lot for a Scout Patrol to make happen in just 10 minutes! A Patrol could sit out of Interpatrol Activity time (usually about 20 minutes), but that is a highlight of a unit meeting for them, and not having a Patrol participate might derail the competitive activity. There is the possibility of holding Scouts after the meeting—especially in the summer—but ensure parents know!!

In general, trying to do advancement activities during a troop meeting is a bad idea; but if it must be done, get the blessing of the ScoutMaster and ensure they guide the PLC through how to make it happen.

GENERAL RESOURCES FOR NOVA COUNSELORS

Adult Application, No. 28-501 This adult registration form consists of a cover sheet, an instruction and information sheet, and a four-part registration form. It is used for all BSA volunteers, including Nova counselors and Supernova mentors. Completion of the form is required of all merit badge counselors regardless of whether they are already a registered Scouter. Adults should use the counselor registration code 51 or mentor registration code 52. The form is available online at http://www.scouting.org/filestore/pdf/524-501.pdf

Advancement Committee Guide Policies and Procedures, No. 33088 This is the handbook for Scouters responsible for advancement at the council, district, and unit levels. It contains the current BSA advancement policies, procedures, rules, and regulations as well as other information.

Boy Scout Handbook, No. 33105 This is the critical document for a Scout, providing the basic information for all facets of Scouting, including a chapter on the merit badge program.

Boy Scout Requirements, No. 33215 Updated yearly, this book contains the complete, official requirements for all BSA merit badges, ranks, and special awards. Requirements in this publication may be more current than the Nova guidebooks; therefore, the Boy Scout Requirements takes precedence. The material is available online.

A Guide for Merit Badge Counseling, No. 34532 This folder gives potential merit badge counselors an introduction to the advancement program and the merit badge counselor's role. It also lists all the current merit badge subjects. This material is a good resource for Supernova mentors, who play a similar role.

Supernova Mentor Application form, No. 514-017 When attached to the Adult Application, this document specifies the Supernova subjects a mentor wants to coach and secures the mentor's agreement to follow the award requirements and BSA policies. This form is available online at http://www.scouting.org/filestore/stem/pdf/514-017_WB.pdf

Nova Guidebook Series The Nova Guidebooks are written for Scout-age youth, Cub Scouts and Webelos, Boy Scouts, and Venture Scouts. The information presented in the pamphlet will help the counselor and mentor understand what the Scout may be studying and the level of learning expected by the Boy

Scouts of America. The guidebooks may also contain suggestions for projects or demonstrations required to earn the awards. At times, the requirements presented in the guidebooks may not match those in the current edition of the *Boy Scout Requirements* book. The *Boy Scout Requirements* criteria take precedence. Once a Scout has started working on a merit badge, she may stay with the requirements in effect when she started. She is not required to meet newly introduced changes unless the national office places a specific timeline on the implementation of new requirements.

Scoutmaster Handbook, No. 33009 As the Scoutmaster's primary guide, the Scoutmaster Handbook contains a section on the merit badge program that includes tips on recruiting counselors and other advancement resources. These tips apply to recruiting Nova counselors and Supernova mentors

Publicity Flyer: Greater Alabama Council created an awesome 2-sided flier that you can use. My only caution is that they show the Blue-bordered patch, which is only for Cub Scouts!
https://1bsa.org/tyfoon/site/fckeditor/file/2013%20NOVA-SUPERNOVA_promo%20v1a.pdf

STEM Resources The Silicon Valley Monterey Bay Council has a number of helps that they publish:
http://www.bsastemresources.com/

BSA Philmont Training Center BSA offers two national-level STEM classes for Scouters at Philmont (http://www.scouting.org/Philmont/PTC.aspx):

- Introduction to STEM (Science, Technology, Engineering, Mathematics)
- Taking STEM to the Next Level

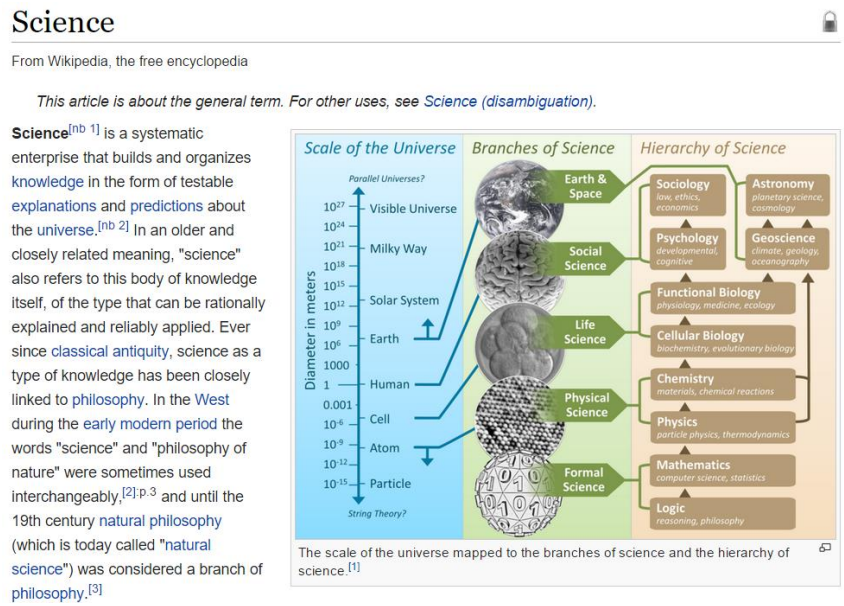
Out of This World BSA STEM Video:
https://www.youtube.com/watch?t=99&v=nG73nvHd548&noredirect=1

Semi-Pro BSA Blogs:

- http://blog.scoutingmagazine.org/2015/09/18/how-to-find-stem-experts-for-your-next-scout-meeting-or-event/
- http://scoutmastercg.com/stemnova-january-2013-scoutcircle/

Shoot!

This guide doesn't tell you what you must do or how you must do it—it just helps speed you up if you decide to choose the easier path. However, I encourage you to explore the road less travelled!


Science

From Wikipedia, the free encyclopedia

This article is about the general term. For other uses, see Science (disambiguation).

Science[nb 1] is a systematic enterprise that builds and organizes knowledge in the form of testable explanations and predictions about the universe.[nb 2] In an older and closely related meaning, "science" also refers to this body of knowledge itself, of the type that can be rationally explained and reliably applied. Ever since classical antiquity, science as a type of knowledge has been closely linked to philosophy. In the West during the early modern period the words "science" and "philosophy of nature" were sometimes used interchangeably,[2]:p.3 and until the 19th century natural philosophy (which is today called "natural science") was considered a branch of philosophy.[3]

The scale of the universe mapped to the branches of science and the hierarchy of science.[1]

WHAT TO REVIEW FIRST

Familiarize yourself with the overview sections that opened this document.

You can get a "cliff-notes" version of what the Scout must do here: http://www.scouting.org/stem/Awards/BoyScouts.aspx#shoot .

Closely read the "Shoot!" section of the current Nova Guidebook Series. Searching online might find a PDF version of the full resource (http://www.sccbsa.org/docs/stem_scout_guidebook.pdf), but the BSA wants you to buy the current book from the Council Scout Store—check with the unit Librarian to see if the unit already owns a copy of the current version!

*** The information for this Nova award will appear in two different locations in the BSA Nova Guidebook. The first part is on pages 11 – 16 and states the requirements along with places to look for more information. The second part is on pages 62 – 69. This second part is meant for the counselor to use. At the beginning it is a near-duplicate of the earlier part—but by requirement 3(3)(a), the second section begins to provide additional explanatory information that the counselor will find helpful.

A projectile is:
- An object that is fired, launched, or thrown, but which cannot propel itself
- A self-propelled missile, like a rocket

If you have time, Google "BSA STEM NOVA Shoot" and see what you find. Expand your search terms, and look for videos/etc. The Greater St Louis Council (GSLAC) has perhaps the best / biggest BSA STEM program in the country—don't neglect reviewing it (http://stlbsa.org/activities/other-activities/stem/)!

HOW TO PRESENT

> CAUTION: One of the complications of the Nova requirements is that there is a high amount of choice—this was done so Scouts could pick what interested them personally. However, if presenting this in a small group setting, the counselor will probably have to personally choose which alternative requirements will be done. If so, make this clear from the onset so there aren't upset parents who want Johnny to do something you aren't prepared to support.

Pre-Requisites:

> Given that caution, there are parts of this award that the Scout could best do at home:

1. Reading or Watching and developing questions (requirements 1A / 1Ai, 1B / 1Bi, or 1C / 1Ci) are great pre-reqs.

2. Accomplishing one of the listed Merit Badges is a great pre-req. If counseling this award as part of a larger STEM event, consider offering some of these merit badges in morning sessions, then offer the Nova awards in the afternoon sessions. Caution: STEM merit badge requirements can be very substantial, and to meaningfully accomplish them, it may require 6+ hours of counseling (with pre-reqs).

3. Finding and downloading an app onto a smartphone is best done as a pre-req, because Scouts may not have the password to do that (the initial part of 3A). Accomplishing the rest of this would be better done with the counselor, but consider the environment: will cellphones work where this is being counseled? If Scouts are younger than 13, they may not have computer accounts—the Federal Trade Commission's Childrens Online Privacy Protection Act (COPPA: http://www.coppa.org/) puts exacting requirements on companies who give children computer accounts—so most won't. If choosing requirement 3B, then the online discovery and analysis portions (3B i, ii, and iii) would be better done at home.

4. The visit to an observatory or museum would be easier done as a pre-req (4Ai). If 4B is chosen, then the research and observation for i and ii would be best done at home [it would be very hard to do 4B ii during the daytime!].

5. This requirement would be best done in the presence of the counselor—it should be a fun memory the Scout takes with them of earning this award!

6. This requirement would be best done in the presence of the counselor.

In the presence of a counselor

Some examples include—but are not limited to—shows found on PBS ("NOVA"), Discovery Channel, Science Channel, National Geographic Channel, TED Talks (online videos), and the History Channel. You may choose to watch a live performance or movie at a planetarium or science museum instead of watching a media production. You may watch online productions with your counselor's approval and under your parent's supervision.

1. To have the most control over this requirement in order to have the best quality discussion, the counselor would pre-select items for the Scout to read and watch on their own. However, in practice this is a hard thing to do. Also, Scouts are much more likely to watch videos for three hours than read for three hours! Selecting online videos is tough because it presumes Scout access to the Internet and most videos aren't well suited to keeping the interest of a Scout (https://www.youtube.com/watch?v=NfadhJgZpCg). It is best to point the Scout to the list of helpful sources shown in the Nova Guidebook and have them select what to watch/read. If you have some of the magazines listed as potential reading, offer to lend one or two to the Scout for them to review. When the Scout meets with you again, find out what they watched/read, what it was about, what they learned, and why they picked that item. Look at their written-out questions and pick the two that you are most able to talk to, asking them to present their question and helping them find an answer. Be sure to help them understand what the practical applications might be. Hint: you may want to have a smartphone or computer handy! Spend 10 – 15 minutes on this.

Examples of magazines include—but are not limited to—*Odyssey, Popular Mechanics, Popular Science, Science Illustrated, Discover, Air & Space, Popular Astronomy, Astronomy, Science News, Sky & Telescope, Natural History, Robot, Servo, Nuts and Volts,* and *Scientific American.*

2. Determine which merit badge the Scout earned and document that because the same merit badge can't be claimed multiple times in the Nova and SuperNova awards system. Unless you

already counsel that merit badge, you may find it helpful to pull up a copy of the merit badge requirements / worksheet from sources like http://meritbadge.org/wiki/index.php/Merit_Badges . Find out what the Scout found interesting about that badge, then ask how science was used in the badge. 10 mins.

3. I suggest making the choice to take the Scout down a hands-on track to learn about projectiles (3A). Show the Scout Angry Birds and let them play a couple rounds on an easy level. Then introduce the concept of vectors through a simulation that you can coach them through. The free ones are breaking all the time due to changes in Java/runtimes, but currently the one I like the most is: http://www.physicsclassroom.com/Physics-Interactives/Vectors-and-Projectiles/Projectile-Simulator/Projectile-Simulator-Interactive . With the Scouts armed with basic information, have them do some experiments: one can make a yoke with the rubber band between two of their fingers and fire the ping pong ball at different angles (use the protractor). The other Scout can set up a cell phone to record the shot and help measure the angle. It will be easiest if this is done with some reference in the background—a concrete block wall will work—so the Scouts can get a good idea of how high and how far it went (3 blocks high, 5 blocks long). Make it easy to catch the ping pong balls! If safety allows, have them try with a golf ball and compare results. This should be a Scout activity, with you asking leading questions during the process. Spend 15 – 30 minutes on these three activities (always leave the Scout wanting more, rather than asking if they are done).

4. The easiest way to do this is for the Scout to make the visit with their family. However, you might win "cool" points for helping the Scout to see the Space Station pass over…but prepare to be up very focused, very briefly and at a crazy hour (http://spotthestation.nasa.gov/sightings/view.cfm?country=United_States&region=Illinois&city=Belleville#.VfXVwvlVhBc)! Maybe this is something best done on a campout, especially one far away from city lights. Whatever you choose to do, the after-action discussion portion should take 5 – 10 minutes.

5. For this one, I suggest choosing the 5A Catapult option. Catapults are easy to build—but pick designs that are less likely to create a safety issue. Low-yield designs are possible (http://www.stormthecastle.com/catapult/popsiclestick-catapult.htm), but here I've chosen a "cool factor" design that will have to be used outdoors (https://www.youtube.com/watch?t=221&v=XXPD4nMED-k) and has less likelihood to mis-fire. After a safety brief, build and use the catapult. Make charts. Ask Scouts to analyze and discuss their results with you. Plan on this taking 30 – 45 minutes, but watch the clock! Have a large open area to work in, with good light.

6. Spend about 5 – 10 minutes recapping the award by discussing this.

WHAT SUPPLIES ARE NEEDED / COSTS

1B/C: Potentially some physical magazines ($30). Vet the content before giving to a Scout!!
3A: Protractor $1 each
3A: Rubber Band $3 bag
3A: Yardstick $2 each
3A: Ping pong ball $11 for a bunch
3A: Golf Ball $9 for about 24
5A: Small/Med Metal Binder Clips $1 for 12
5A: Popsicle (Craft) Sticks $2 for 100
5A: Zip ties (small) $2 for 100
5A: Diagonal Cutters $16 each
5A: Mini marshmallows $4 for a bag

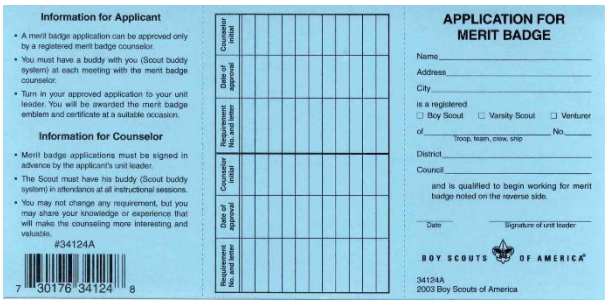
EXPECTED COSTS

If you were running 10 Scouts through this activity and had no cache of supplies, expect the cost to be about $94 ($10 Each). If you do this a couple times, you will wind up with a toolbox of spare/multi-use items, and future costs can be less. Buy online, look at craft or teacher supply stores, drive over to SIUE and see what their STEM Center (http://www.siue.edu/stem/) will provide you.

TIME

Apart from reading this guide, preparing, purchasing, and the normal pleasantries, patience, and paperwork that counseling involves, expect this to require 75 – 130 minutes. If you break it up into multiple sessions and have multiple Scouts, be prepared for "clean up"—Scouts will rapidly diverge in their progress, and future sessions won't be as efficient as you hoped (they quickly become "individual" sessions).

HOW TO DOCUMENT PROGRESS AND COMPLETION



Officially, the Scout is responsible for keeping track of their progress. However, there is no official aid—like the Merit Badge Blue Card—for certifying which individual requirements the Scout has completed. It has become common for Councils to implement "unofficial" worksheets that each Scout uses (http://www.bsastemresources.com/uploads/8/4/7/7/8477978/wrksht_bs_science.pdf). Since these are unofficial, don't sole rely on them—BSA requirements change all the time! It can also be a problem if Scouts lose their worksheet between sessions. If the counselor wants to keep a personal record, either develop a spreadsheet or (after validating for currency) use Figure 3.

Please use the Advancement Report, No.34403, as documentation of completion for the Nova Award—see your unit Advancement Chair for assistance.

BSA Nova Shoot! **Progress Record**

Scout *Printed* Name: _____

Unit of Scout: Troop _____ in BSA District: _____ in BSA Council: _____

ScoutMaster Approval *Signature* (for Scout to do this, with which Counselor): _____

Counselor *Printed* Name: _____

Requirement # and Letter	Date of Approval	Counselor Initial
1 (A, B, or C) i		
1 (A, B, or C) ii		
2: Did which MB: _____	Date Earned:	
3 (A or B) i		
3 (A or B) ii		
3 (A or B) iii		
4 (A or B) i		
4 (A or B) ii		
5 (A, B or C) i		
5 (A, B or C) ii		
5 (if B) iii		
6		

Note: In each requirement, circle which option was chosen. Stay consistent within the requirement!

ScoutMaster Acknowledgement of Completion: _____

Unit Advancement Chair Acknowledgement of inclusion in Unit Advancement Report: _____

Figure 3Shoot! Blue Card Surrogate

RECOGNITION

There are four steps to Scout Advancement (http://scoutmastercg.com/scout-advancement-a-scout-is-recognized/):

1. A Scout Learns
2. A Scout is Tested
3. A Scout is Reviewed
4. A Scout is Recognized

When a Scout advances, he should be recognized as soon as possible–preferably at the next unit meeting. He is recognized a second time at a public ceremony called a court of honor. The main purposes of the court of honor are to furnish formal recognition for achievement and to provide incentive for other Scouts to advance. Formal courts of honor should be conducted at least four times a year. All Scouts who have advanced since the previous court of honor are honored. Their parents and friends should be invited to attend the ceremony. Suggestions on court of honor agendas and ceremonies are found in Troop Program Resources for Boy Scout Leaders.

Troop Committee Guidebook

Find fun ways to support these Scouting principles! For example, at the end of your award session, rather than just signing and handing over "Johnny did this" slips, make a big deal about presenting the Scouts with the catapults they created in pursuit of the award, with personalized comments like "highest flyer!". Get the paperwork back to the unit Advancement Chair along with a heads-up in advance so that the right Nova patch or pin is on-hand and can be presented to the Scout at the end of their next meeting. Attend the next unit Court of Honor and congratulate your charges after they get their formal recognition in front of their parents.

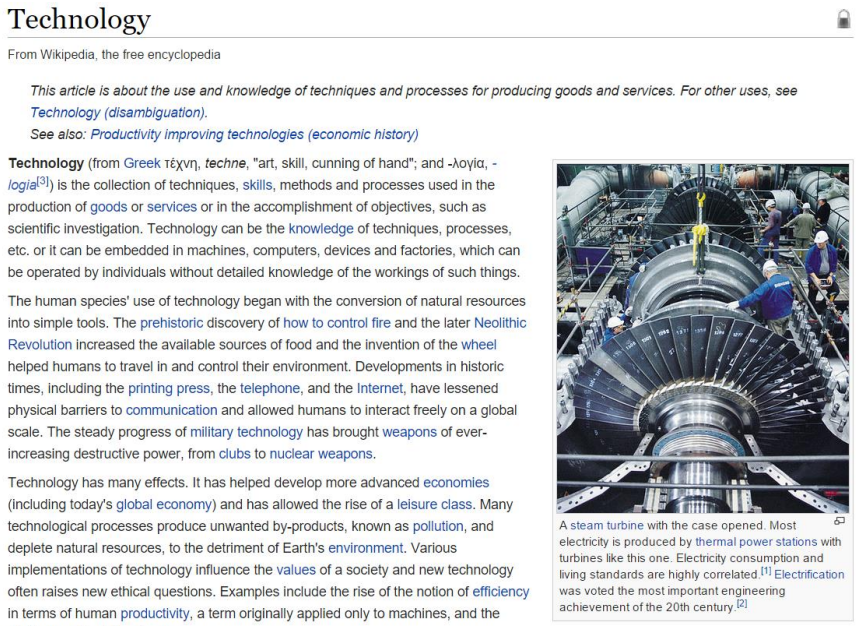
Finally, thank you for toiling harder than anyone knew in order to help Scouts become Scientists!

HELPFUL LINKS:

http://www.mhhe.com/physsci/physical/giambattista/proj/projectile.html
http://galileoandeinstein.physics.virginia.edu/more_stuff/Applets/ProjectileMotion/jarapplet.html
http://www.walter-fendt.de/ph14e/projectile.htm
http://www.regentsprep.org/Regents/physics/phys-topic.cfm?Course=PHYS&TopicCode=01a
http://www.physicsclassroom.com/class/1dkin/u1l5b.cfm
http://www.physicsclassroom.com/class/vectors/u3l2a.cfm
http://hyperphysics.phy-astr.gsu.edu/hbase/vesc.html
http://www.grg.northwestern.edu/projects/vss/docs/space-environment/2-whats-escape-velocity.html
http://er.jsc.nasa.gov/seh/feather.html
http://hypertextbook.com/facts/JianHuang.shtml
http://www.braeunig.us/space/orbmech.htm
http://www.eumetsat.int/website/home/Satellites/index.html?l=en
http://www.esa.int/Our_Activities/Space_Science/What_is_a_launch_window
http://www.npr.org/templates/story/story.php?storyId=4749663
http://www.nasa.gov/audience/forstudents/brainbites/nonflash/bb_home_launchwindow.html
http://exploration.grc.nasa.gov/education/rocket/termvr.html
http://www.heavens-above.com/

Start Your Engines!

This guide doesn't tell you what you must do or how you must do it—it just helps speed you up if you decide to choose the easier path. However, I encourage you to explore the road less travelled!



Technology

From Wikipedia, the free encyclopedia

This article is about the use and knowledge of techniques and processes for producing goods and services. For other uses, see Technology (disambiguation).
See also: Productivity improving technologies (economic history)

Technology (from Greek τέχνη, *techne*, "art, skill, cunning of hand"; and -λογία, -*logia*[3]) is the collection of techniques, skills, methods and processes used in the production of goods or services or in the accomplishment of objectives, such as scientific investigation. Technology can be the knowledge of techniques, processes, etc. or it can be embedded in machines, computers, devices and factories, which can be operated by individuals without detailed knowledge of the workings of such things.

The human species' use of technology began with the conversion of natural resources into simple tools. The prehistoric discovery of how to control fire and the later Neolithic Revolution increased the available sources of food and the invention of the wheel helped humans to travel in and control their environment. Developments in historic times, including the printing press, the telephone, and the Internet, have lessened physical barriers to communication and allowed humans to interact freely on a global scale. The steady progress of military technology has brought weapons of ever-increasing destructive power, from clubs to nuclear weapons.

Technology has many effects. It has helped develop more advanced economies (including today's global economy) and has allowed the rise of a leisure class. Many technological processes produce unwanted by-products, known as pollution, and deplete natural resources, to the detriment of Earth's environment. Various implementations of technology influence the values of a society and new technology often raises new ethical questions. Examples include the rise of the notion of efficiency in terms of human productivity, a term originally applied only to machines, and the challenge of traditional norms.

A steam turbine with the case opened. Most electricity is produced by thermal power stations with turbines like this one. Electricity consumption and living standards are highly correlated.[1] Electrification was voted the most important engineering achievement of the 20th century.[2]

WHAT TO REVIEW FIRST

Familiarize yourself with the overview sections that opened this document.

You can get a "cliff-notes" version of what the Scout must do here: http://www.scouting.org/stem/Awards/BoyScouts.aspx#start .

Closely read the "Start Your Engines!" section of the current Nova Guidebook Series. Searching online might find a PDF version of the full resource (http://www.sccbsa.org/docs/stem_scout_guidebook.pdf), but the BSA wants you to buy the current book from the Council Scout Store—check with the unit Librarian to see if the unit already owns a copy of the current version! Note: The links in the online one are live!

*** The information for this Nova award will appear in two different locations in the BSA Nova Guidebook. The first part is on pages 17 – 19 and states the requirements along with places to look for more information. The second part is on pages 70 – 74. This second part is meant for the counselor to use. At the beginning it is a near-duplicate of the earlier part—but by requirement 3(3)(a), the second section begins to provide additional explanatory information that the counselor will find helpful.

Other sources of energy may include wind, solar power, and biofuels, which draw energy from what is called biological carbon fixation. The most common biofuel is ethanol from corn, although it can also come from sugar cane, sugar beets, wheat, molasses, potatoes, and fruit waste. Biodiesel sources include algae, animal and vegetable oil, hemp, flax, and sunflowers.

If you have time, Google "BSA STEM NOVA Start Your Engines" and see what you find. Expand your search terms, and look for videos/etc. The Greater St Louis Council (GSLAC) has perhaps the best / biggest BSA STEM program in the country—don't neglect reviewing it (http://stlbsa.org/activities/other-activities/stem/)!

HOW TO PRESENT

> CAUTION: One of the complications of the Nova requirements is that there is a high amount of choice—this was done so Scouts could pick what interested them personally. However, if presenting this in a small group setting, the counselor will probably have to personally choose which alternative requirements will be done. If so, make this clear from the onset so there aren't upset parents who want Johnny to do something you aren't prepared to support.

Pre-Requisites:

Given that caution, there are parts of this award that the Scout could best do at home:

1. Reading or Watching and developing questions (requirements 1A / 1A1, 1B / 1B1, or 1C / 1C1) are great pre-reqs.

2. Accomplishing one of the listed Merit Badges is a great pre-req. If counseling this award as part of a larger STEM event, consider offering some of these merit badges in morning sessions, then offer the Nova awards in the afternoon sessions. Caution: STEM merit badge requirements can be very substantial, and to meaningfully accomplish them, it may require 6+ hours of counseling (with pre-reqs).


Boy Scouts of America > Guide to Advancement 2015 > The Merit Badge Program

The Merit Badge Program

7.0.0.1 The Benefits of Merit Badges

There is more to merit badges than simply providing opportunities to learn skills. There is more to them than an introduction to lifetime hobbies, or the inspiration to pursue a career—though these invaluable results occur regularly. It all begins with a Scout's initial interest and effort in a merit badge subject, followed by a discussion with the unit leader or designated assistant, continues through meetings with a counselor, and culminates in advancement and recognition. It is an uncomplicated process that gives a Scout the confidence achieved through overcoming obstacles. Social skills improve. Self-reliance develops. Examples are set and followed. And fields of study and interest are explored beyond the limits of the school classroom.

3. The second requirement is the pre-req for accomplishing the first third of this third requirement.

4. It is best to accomplish this requirement in the presence of the counselor who can supply a parts bin and leading questions. However, for older Scouts or Scouts who are technology-inclined, they may gain far more by accomplishing 4A, 4B, and the initial part of 4C on their own. The counselor should expect to be surprised at the inventiveness of the Scout! Note: Be clear early on so the Scout doesn't build a kit!

5. This requirement would be best done in the presence of the counselor.

In the presence of a counselor

Some examples include—but are not limited to—shows found on PBS ("NOVA"), Discovery Channel, Science Channel, National Geographic Channel, TED Talks (online videos), and the History Channel. You may choose to watch a live performance or movie at a planetarium or science museum instead of watching a media production. You may watch online productions with your counselor's approval and under your parent's supervision.

1. To have the most control over this requirement in order to have the best quality discussion, the counselor would pre-select items for the Scout to read and watch on their own. However, in practice this is a hard thing to do. Also, Scouts are much more likely to watch videos for three hours than read for three hours! Selecting online videos is tough because it presumes Scout access to the Internet. However, you can find some interesting ones in this category that may keep the interest of a Scout (https://www.youtube.com/watch?v=08KiXviZYww). It is best to point the Scout to the list of helpful sources shown in the Nova Guidebook and have them select what to watch/read. If you have some of the magazines listed as potential reading, offer to lend one or two to the Scout for them to review. When the Scout meets with you again, find out what they watched/read, what it was about, what they learned, and why they picked that item. Look at their written-out questions and pick the two that you are most able to talk to, asking them to present their question and helping them find an answer. Be sure to help them understand what the practical applications might be. Hint: you may want to have a smartphone or computer handy! Spend 10 – 15 minutes on this.

Examples of magazines include—but are not limited to—*Odyssey, Popular Mechanics, Popular Science, Science Illustrated, Discover, Air & Space, Popular Astronomy, Astronomy, Science News, Sky & Telescope, Natural History, Robot, Servo, Nuts and Volts,* and *Scientific American.*

2. Determine which merit badge the Scout earned and document that because the same merit badge can't be claimed multiple times in the Nova and SuperNova awards system. Unless you already counsel that merit badge, you may find it helpful to pull up a copy of the merit badge requirements / worksheet from sources like http://meritbadge.org/wiki/index.php/Merit_Badges . Find out what the Scout found interesting about that badge, then ask how technology was used in the badge. 10 mins.

Automotive Maintenance—gasoline, diesel fuel, electricity, blended gasoline, biodiesel, hybrid

Aviation—aviation fuel and kerosene

Canoeing—human power

Cycling—human power

Drafting—human power, electricity

Electricity—electromagnetism, chemical

Energy—biomass digesters, cogeneration, fossil fuel power, fuel cells, geothermal power, nuclear power, solar power, tidal energy, wave energy, ocean thermal energy, wind

Farm Mechanics—diesel fuel

Motorboating—gasoline, diesel fuel, blended gasoline, biodiesel

Nuclear Science—nuclear energy

Railroading—diesel fuel

Small-Boat Sailing—wind

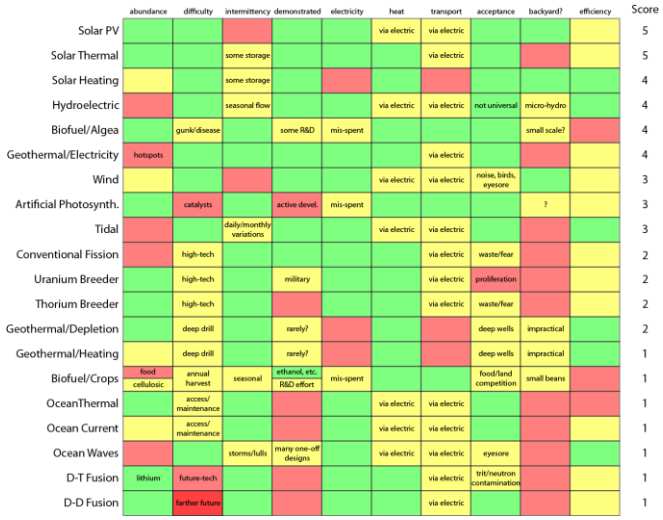
Space Exploration—most common solid is ammonium perchlorate mixed with powdered aluminum

Liquids for first-stage rockets—RP-1

Liquids for second-stage rockets—liquid hydrogen, liquid oxygen

Truck Transportation—diesel fuel

3. Requirements 3A1 and 3A2 are very easy for the counselor, thanks to the helpful list of energy sources on Page 71! On Pages 72 & 73, there are links to several websites that a counselor can *become familiar with in advance* in order to better discuss pros and cons (and future applications) of energy sources….but don't stop there; you may find helpful work all over the Internet (like http://physics.ucsd.edu/do-the-math/wp-content/uploads/2012/02/energy-score.png).



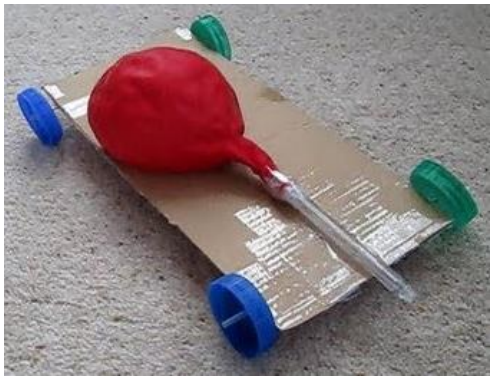
	abundance	difficulty	intermittency	demonstrated	electricity	heat	transport	acceptance	backyard?	efficiency	Score
Solar PV						via electric	via electric				5
Solar Thermal			some storage				via electric				5
Solar Heating			some storage								4
Hydroelectric			seasonal flow			via electric	via electric	not universal	micro-hydro		4
Biofuel/Algea		gunk/disease		some R&D	mis-spent				small scale?		4
Geothermal/Electricity	hotspots						via electric				4
Wind						via electric	via electric	noise, birds, eyesore			3
Artificial Photosynth.		catalysts		active devel.	mis-spent				?		3
Tidal			daily/monthly variations			via electric	via electric				3
Conventional Fission		high-tech					via electric	waste/fear			2
Uranium Breeder		high-tech		military			via electric	proliferation			2
Thorium Breeder		high-tech					via electric	waste/fear			2
Geothermal/Depletion		deep drill		rarely?				deep wells	impractical		2
Geothermal/Heating		deep drill		rarely?				deep wells	impractical		1
Biofuel/Crops	food cellulosic	annual harvest	seasonal	ethanol, etc. R&D effort	mis-spent			food/land competition	small beans		1
OceanThermal		access/ maintenance				via electric	via electric				1
Ocean Current		access/ maintenance				via electric	via electric				1
Ocean Waves			storms/lulls	many one-off designs		via electric	via electric	eyesore			1
D-T Fusion	lithium	future-tech					via electric	trit/neutron contamination			1
D-D Fusion		farther future					via electric				1

This requirement is pretty easy, but easy won't be memorable. Consider spicing it up by not just talking about pros and cons or applications, but actually demonstrating them (safely!). This doesn't have to be hard (and is even better if something the Scout could "show off" to family. For example, why not build a potato battery and ask the Scout why you wouldn't want to make a potato-powered electric car (https://www.youtube.com/watch?v=iX56mc7F1sA)…although they do work on one day of the year (https://www.youtube.com/watch?v=YSa7IgUT-hU). 15 – 20 min.

4. This is the only tricky (and costly?) part of this award activity; how you do it depends greatly on what parts you can bring and/or if your Scouts have the capacity and capability to perhaps do the creative sourcing and building at home (without violating the rule on no kits). Read the requirement carefully—it requires creating a vehicle of the Scout's own design that moves due to solar, wind, or battery power. For example, it never says "wheeled." It says "not from a kit", not "not from kit parts." Consider whether you want to provide specifications—for example, will you compete vehicles at the end—for speed? Distance? Originiality? Etc? Be prepared to ask leading questions to help the Scout ideate a design. It may help them if you can show pictures or short videos. What they build probably depends on what they have access to. If you provide materials, try to let them have something they can take home with them—the item will invoke the memory, which will reinforce the learning. You could provide "seed material" for

them to use. Legos are a great start for very modular, lightweight, and relatively strong designs. There are several "educational" Lego offerings of wheels, axels, etc that may be useful:

- http://www.amazon.com/LEGO-Education-Wheels-4598357-Pieces/dp/B004HXCX3I
- http://www.amazon.com/gp/product/B00XZIMDFO/ref=pd_lpo_sbs_dp_ss_1?pf_rd_p=1944687762&pf_rd_s=lpo-top-stripe-1&pf_rd_t=201&pf_rd_i=B004HXCX3I&pf_rd_m=ATVPDKIKX0DER&pf_rd_r=0MAR1PPTDN7T4E2BHY36



The problem is that cost rapidly gets high. There are ways to re-use trash to form the bulk of an innovative design:

- Real cheap wind-powered balloon car: https://www.youtube.com/watch?v=QzY9RH_JnL0
- Bottle 9v Battery car: https://www.youtube.com/watch?v=voT-xADi-RE

Alternate source for motor: http://www.amazon.com/8000RPM-Torque-Magnetic-Cylindrical-Motor/dp/B00B0QOUK4/ref=pd_sim_60_9?ie=UTF8&refRID=05SBPGSJ4ZTDJB82ET3N

You may also want to get alligator clips: http://www.amazon.com/Elenco-TL-6-Alligator-10-Piece-inches/dp/B0002JJU28/ref=pd_bxgy_60_text_z

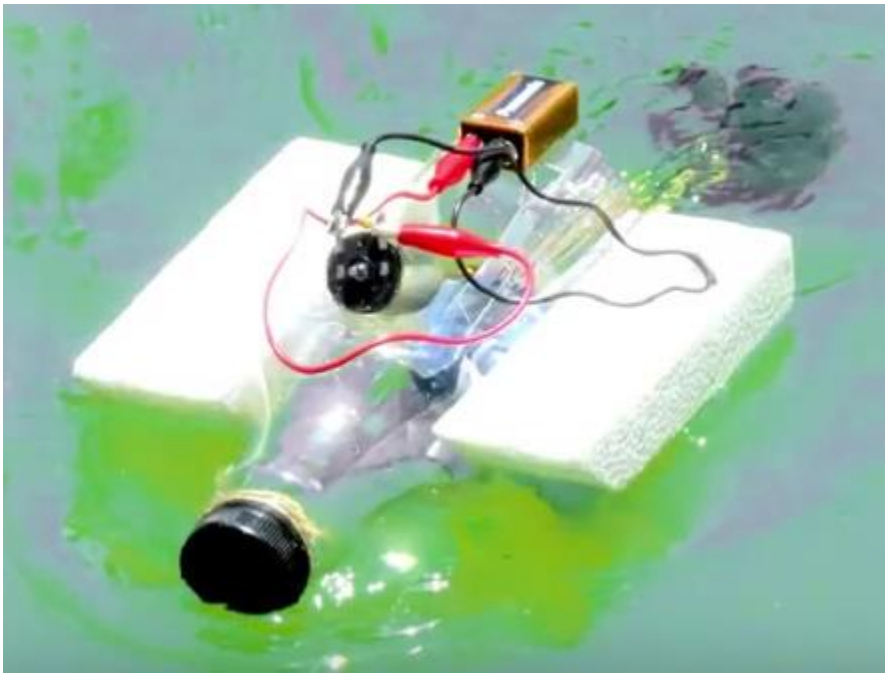
- Battery powered toothbrush boat: https://www.youtube.com/watch?v=jozN2szewSo
- Consider a solar boat regatta: https://www.youtube.com/watch?v=bDUGMvx68LY

If you are lucky and have access to a well-stocked lab or parts bin, that will really increase options. If you don't, then you probably want to avoid designs that will require you to deal with gearing (beyond simple 1:1 mating or primitive means like rubber band belts, etc). This means keeping things very light and probably mostly wind-based. Solar cells rapidly get expensive; they produce little power, so require a low voltage motor. Battery-powered electric motors are great if you can match the motor and battery voltage, don't need electrical components like resistors/capacitors, and can stay away from needing gearboxes.

The vehicle doesn't have to be fancy—the important part is discovery and discussion. Real simple concepts include:

Toothbrush bot:
https://www.youtube.com/watch?v=PoLHwaj4WV4

How about a simple sailboat from balsa? A bottle?
https://www.youtube.com/watch?v=YH9r21FWRBY



There are tons of concepts about how to achieve motion with technology:
https://www.youtube.com/watch?v=8_-7Ri-tbHY

Whatever you choose to do, plan for it to take 45 – 60 minutes.

5. Spend about 5 – 10 minutes recapping the award by discussing this.

WHAT SUPPLIES ARE NEEDED / COSTS

1B/C: Potentially some physical magazines ($30). Vet the content before giving to a Scout!!
4A Graph Paper (http://www.amazon.com/Engineering-Computation-Letter-Sheets-35500/dp/B001J87JTM/ref=sr_1_1?s=office-products&ie=UTF8&qid=1442705860&sr=1-1&keywords=engineering+paper) $7 for 100 sheets
4A: Triangular Scale (http://www.amazon.com/Alvin-12-Inch-Architect-Triangular-110P/dp/B001DNHG64/ref=pd_sim_229_4?ie=UTF8&refRID=0FRF9RX64EQTMDSE3AG7&dpID=41wDrmNjXRL&dpSrc=sims&preST=_AC_UL160_SR160%2C160_) $6 Ea
4B: Supplies and Costs vary widely by vehicle chosen & how good a scrounger you/Scouts are! Here I will fully cost out the bottle battery car because it just seems cool.

- Two empty 20 Fl Oz plastic bottles per car (free – or $4 if you have to buy unused ones)
- Bottle Caps (http://www.freundcontainer.com/water-bottle-tamper-evident-cap/p/4691C01/), $0.16 for 4
- Tea Candles (http://www.amazon.com/GoodLight-Paraffin-free-Tea-Lights-Pack/dp/B00LBJ15LM/ref=sr_1_5?ie=UTF8&qid=1442706997&sr=8-5&keywords=tea+candle), $3 for 6.
- Matches (http://www.amazon.com/Diamond-Strike-Box-Greenlight-Matches/dp/B003Y30NFW/ref=sr_1_1?ie=UTF8&qid=1442707295&sr=8-1&keywords=matches), $5 for 300.
- Soda Straw (http://www.amazon.com/ChefLand-Flexible-Disposable-Drinking-Straws/dp/B00R9DBWMG/ref=sr_1_3?ie=UTF8&qid=1442707433&sr=8-3&keywords=straw), $7 for 400
- Small diameter Dowel Rod (http://www.amazon.com/Darice-9162-01-Unfinished-Natural-8-Inch/dp/B002761TPA/ref=sr_1_12?ie=UTF8&qid=1442707596&sr=8-12&keywords=dowel+rod), $4 for 22
- Motor (http://www.amazon.com/8000RPM-Torque-Magnetic-Cylindrical-Motor/dp/B00B0QOUK4/ref=pd_sim_60_9?ie=UTF8&refRID=05SBPGSJ4ZTDJB82ET3N), $7 EA
- Jumpers (http://www.amazon.com/Elenco-TL-6-Alligator-10-Piece-inches/dp/B0002JJU28/ref=pd_bxgy_60_img_3?ie=UTF8&refRID=1RHYAB476ZD0JVAN8XC9), $4 for 10
- Hot Glue Gun w/ Glue (http://www.amazon.com/Surebonder-DT-200KIT-Mini-Dual-Temperature/dp/B001AQRLM8/ref=sr_1_4?s=office-products&ie=UTF8&qid=1442706478&sr=1-4&keywords=hot+glue), $10 EA
- Scissors (http://www.amazon.com/Scotch-1448-Precision-Scissor-8-Inches/dp/B001BKHHGS/ref=sr_1_1?s=office-products&ie=UTF8&qid=1442707974&sr=1-1&keywords=scissors), $6 EA
- Xacto Knife (http://www.amazon.com/X-ACTO-Knife-Cap-Silver-X3602/dp/B000V1QV7O/ref=sr_1_1?s=office-products&ie=UTF8&qid=1442708011&sr=1-1&keywords=xacto+knife), $6 EA
- Sharpie (http://www.amazon.com/Sharpie-Point-Permanent-Markers-30001/dp/B00006IFHD/ref=sr_1_1?s=office-products&ie=UTF8&qid=1442708039&sr=1-1&keywords=sharpie), $6 for 12
- 9V battery (Note: slightly dead ones are better than new—less need to buffer motor w/ resistor) (http://www.amazon.com/AmazonBasics-Everyday-Alkaline-Batteries-8-

Pack/dp/B00MH4QM1S/ref=sr_1_2?ie=UTF8&qid=1442708509&sr=8-2&keywords=9+v) $10 for 8

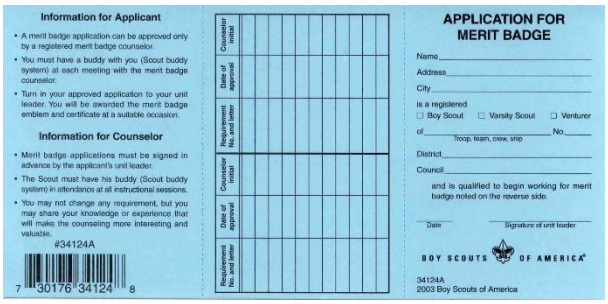
EXPECTED COSTS

If you were running 10 Scouts through this activity and had no cache of supplies, expect the cost to be about $298 ($30 Each). If you do this a couple times, you will wind up with a toolbox of spare/multi-use items, and future costs can be much less. Buy online, look at craft or teacher supply stores, drive over to SIUE and see what their STEM Center (http://www.siue.edu/stem/) will provide you. Scrounge!

TIME

Apart from reading this guide, preparing, purchasing, and the normal pleasantries, patience, and paperwork that counseling involves, expect this to require 85 – 115 minutes. If you break it up into multiple sessions and have multiple Scouts, be prepared for "clean up"—Scouts will rapidly diverge in their progress, and future sessions won't be as efficient as you hoped (they quickly become "individual" sessions).

HOW TO DOCUMENT PROGRESS AND COMPLETION



Officially, the Scout is responsible for keeping track of their progress. However, there is no official aid—like the Merit Badge Blue Card—for certifying which individual requirements the Scout has completed. It has become common for Councils to implement "unofficial" worksheets that each Scout uses (http://www.bsastemresources.com/uploads/8/4/7/7/8477978/wrksht_bs_technology.pdf). Since these are unofficial, don't solely rely on them—BSA requirements change all the time! It can also be a problem if Scouts lose their worksheet between sessions. If the counselor wants to keep a personal record, either develop a spreadsheet or (after validating for currency) use Figure 4.

Please use the Advancement Report, No.34403, as documentation of completion for the Nova Award—see your unit Advancement Chair for assistance.

BSA Nova Start Your Engines! **Progress Record**

Scout *Printed* Name: _____

Unit of Scout: Troop _____ in BSA District: _____ in BSA Council: _____

ScoutMaster Approval *Signature* (for Scout to do this, with which Counselor): _____

Counselor *Printed* Name: _____

Requirement # and Letter	Date of Approval	Counselor Initial
1 (A, B, or C) 1		
1 (A, B, or C) 2		
2: Did which MB: _____	Date Earned:	
3A1		
3A2		
3B		
3C1		
3C2		
4A		
4B		
4C1		
4C2		
4C3		
4D1		
4D2		
4D3		
4D4		
5		

Note: In each requirement, circle which option was chosen. Stay consistent within the requirement!

ScoutMaster Acknowledgement of Completion: _____

Unit Advancement Chair Acknowledgement of inclusion in Unit Advancement Report: _____

Figure 4 Start Your Engines!! Blue Card Surrogate

RECOGNITION

There are four steps to Scout Advancement (http://scoutmastercg.com/scout-advancement-a-scout-is-recognized/):

1. A Scout Learns
2. A Scout is Tested
3. A Scout is Reviewed
4. A Scout is Recognized

When a Scout advances, he should be recognized as soon as possible–preferably at the next unit meeting. He is recognized a second time at a public ceremony called a court of honor. The main purposes of the court of honor are to furnish formal recognition for achievement and to provide incentive for other Scouts to advance. Formal courts of honor should be conducted at least four times a year. All Scouts who have advanced since the previous court of honor are honored. Their parents and friends should be invited to attend the ceremony. Suggestions on court of honor agendas and ceremonies are found in Troop Program Resources for Boy Scout Leaders.

Troop Committee Guidebook

Find fun ways to support these Scouting principles! For example, at the end of your award session, rather than just signing and handing over "Johnny did this" slips, make a big deal about presenting the Scouts with the vehicles they created in pursuit of the award, with personalized comments like "fastest car on the midway!". Get the paperwork back to the unit Advancement Chair along with a heads-up in advance so that the right Nova patch or pin is on-hand and can be presented to the Scout at the end of their next meeting. Attend the next unit Court of Honor and congratulate your charges after they get their formal recognition in front of their parents.

Finally, thank you for toiling harder than anyone knew in order to help Scouts become Technologists!

HELPFUL LINKS:

http://www.carsdirect.com/car-buying/diesel-fuel-vs-unleaded-gasoline-understand-the-pros-and-cons
http://www.edmunds.com/fuel-economy/diesel-reborn.html
http://www.carsdirect.com/green-cars/electric-cars-vs-gasoline-cars-get-the-facts
http://www.centennialofflight.net/essay/Evolution_of_Technology/fuel/Tech21.htm
http://www.csgnetwork.com/jetfuel.html
http://www.scientificamerican.com/article/what-kind-of-fuel-do-rock/
http://www.energyquest.ca.gov/transportation/index.html
http://www.edmunds.com/fuel-economy/ethanol-fuel-cell-biodiesel-an-alternative-fuel-overview.html
http://www.afdc.energy.gov/fuels/electricity_benefits.html
http://www.fueleconomy.gov/feg/current.shtml
http://www.popularmechanics.com/cars/hybrid-electric/
http://www.resilience.org/stories/2006-12-03/nasa-alternative-fuels-aviation
http://www.ccs.neu.edu/home/feneric/solar.html
http://gas2.org/2008/03/25/how-solar-panels-could-power-90-of-us-transportation/
http://www.ans.org/pi/ps/docs/ps82.pdf
http://windpowerauthority.com/wind-power-for-cars/
http://www.theguardian.com/environment/2009/jun/19/denmark-wind-electric-cars

Whoosh!

This guide doesn't tell you what you must do or how you must do it—it just helps speed you up if you decide to choose the easier path. However, I encourage you to explore the road less travelled!

Engineering

From Wikipedia, the free encyclopedia

For other uses, see Engineering (disambiguation).

Engineering is the application of mathematics, empirical evidence and scientific, economic, social, and practical knowledge in order to invent, design, build, maintain, research, and improve, structures, machines, tools, systems, components, materials, and processes.

The discipline of engineering is extremely broad, and encompasses a range of more specialized fields of engineering, each with a more specific emphasis on particular areas of applied science, technology and types of application.

The term *Engineering* is derived from the Latin *ingenium*, meaning "cleverness" and *ingeniare*, meaning "to contrive, devise".

The steam engine, a major driver in the Industrial Revolution, underscores the importance of engineering in modern history. This beam engine is on display in the Technical University of Madrid.

WHAT TO REVIEW FIRST

Familiarize yourself with the overview sections that opened this document.

You can get a "cliff-notes" version of what the Scout must do here: http://www.scouting.org/stem/Awards/BoyScouts.aspx#whoosh .

Closely read the "Whoosh!" section of the current Nova Guidebook Series. Searching online might find a PDF version of the full resource (http://www.sccbsa.org/docs/stem_scout_guidebook.pdf), but the BSA wants you to buy the current book from the Council Scout Store—check with the unit Librarian to see if the unit already owns a copy of the current version! Note: The links in the online one are live!

*** The information for this Nova award will appear in two different locations in the BSA Nova Guidebook. The first part is on pages 21 – 23 and states the requirements along with places to look for more information. The second part is on pages 74 – 81. This second part is meant for the counselor to use. At the beginning it is a near-duplicate of the earlier part—but by requirement 3(3)(a), the second section begins to provide additional explanatory information that the counselor will find helpful.

A lever is a rigid bar that turns around a fulcrum or fixed point. The force—a push or a pull that is applied to the lever—is called the effort. The farther the effort is from the fulcrum, the easier it is to use the lever. What the lever moves is called the load or the resistance. Levers can change the direction of motion, make it easier to move something, or cause something to move a greater distance. There are three classes, or types, of levers.

If you have time, Google "BSA STEM NOVA Whoosh" and see what you find. Expand your search terms, and look for videos/etc. The Greater St Louis Council (GSLAC) has perhaps the best / biggest BSA STEM program in the country—don't neglect reviewing it (http://stlbsa.org/activities/other-activities/stem/)!

HOW TO PRESENT

> CAUTION: One of the complications of the Nova requirements is that there is a high amount of choice—this was done so Scouts could pick what interested them personally. However, if presenting this in a small group setting, the counselor will probably have to personally choose which alternative requirements will be done. If so, make this clear from the onset so there aren't upset parents who want Johnny to do something you aren't prepared to support.

Pre-Requisites:

$$\lim_{GPA \to 0} Engineer = Business\ Major$$

Given that caution, there are parts of this award that the Scout could best do at home:

1. Reading or Watching and developing questions (requirements 1A / 1A1, 1B / 1B1, or 1C / 1C1) are great pre-reqs.

2. Accomplishing one of the listed Merit Badges is a great pre-req. If counseling this award as part of a larger STEM event, consider offering some of these merit badges in morning sessions, then offer the Nova awards in the afternoon sessions. Caution: STEM merit badge requirements can be very substantial, and to meaningfully accomplish them, it may require 6+ hours of counseling (with pre-reqs).


Boy Scouts of America > Guide to Advancement 2015 > The Merit Badge Program

The Merit Badge Program

7.0.0.1 The Benefits of Merit Badges

There is more to merit badges than simply providing opportunities to learn skills. There is more to them than an introduction to lifetime hobbies, or the inspiration to pursue a career—though these invaluable results occur regularly. It all begins with a Scout's initial interest and effort in a merit badge subject, followed by a discussion with the unit leader or designated assistant, continues through meetings with a counselor, and culminates in advancement and recognition. It is an uncomplicated process that gives a Scout the confidence achieved through overcoming obstacles. Social skills improve. Self-reliance develops. Examples are set and followed. And fields of study and interest are explored beyond the limits of the school classroom.

3. The first and second parts of this requirement are great pre-reqs. Hint: http://www.constructionknowledge.net/general_technical_knowledge/general_tech_basic_six_simple_machines.php

4. If you have a good playground nearby, then do this during the badge—otherwise, make it a pre-req. If you have an amusement park nearby, then make going there a pre-req.

5. The first part of this requirement is a great pre-req.

6. This requirement would be best done in the presence of the counselor.

Some examples include—but are not limited to—shows found on PBS ("NOVA"), Discovery Channel, Science Channel, National Geographic Channel, TED Talks (online videos), and the History Channel. You may choose to watch a live performance or movie at a planetarium or science museum instead of watching a media production. You may watch online productions with your counselor's approval and under your parent's supervision. One example is the NOVA Lever an Obelisk page on ancient Egypt and the use of levers, available at www.pbs.org/wgbh/nova/egypt/raising/lever.html.

In the presence of a counselor

1. To have the most control over this requirement in order to have the best quality discussion, the counselor would pre-select items for the Scout to read and watch on their own. However, in practice this is a hard thing to do. Also, Scouts are much more likely to watch videos for three hours than read for three hours! Selecting online videos is tough because it presumes Scout access to the Internet. However, you can find some interesting ones in this category that may keep the interest of a Scout (https://www.schooltube.com/video/b92aaeff6cf4431aa6c7/Bill%20Nye%20-%20Simple%20Machines). It is best to point the Scout to the list of helpful sources shown in the Nova Guidebook and have them select what to watch/read. If you have some of the magazines listed as potential reading, offer to lend one or two to the Scout for them to review. When the Scout meets with you again, find out what they watched/read, what it was about, what they learned, and why they picked that item. Look at their written-out questions and pick the two that you are most able to talk to, asking them to present their question and helping

Examples of magazines include—but are not limited to—*Odyssey, Popular Mechanics, Popular Science, Science Illustrated, Discover, Air & Space, Popular Astronomy, Astronomy, Science News, Sky & Telescope, Natural History, Robot, Servo, Nuts and Volts,* and *Scientific American.*

them find an answer. Be sure to help them understand what the practical applications might be. Hint: you may want to have a smartphone or computer handy! Spend 10 – 15 minutes on this.

2. Determine which merit badge the Scout earned and document that because the same merit badge can't be claimed multiple times in the Nova and SuperNova awards system. Unless you already counsel that merit badge, you may find it helpful to pull up a copy of the merit badge requirements / worksheet from sources like http://meritbadge.org/wiki/index.php/Merit_Badges . Find out what the Scout found interesting about that badge, then ask how engineering was used in the badge. 10 mins.

The point of all of these machines is to decrease the force required to move an object by increasing the distance of the motion.

3. Requirements 3A and 3B should be just a discussion between the counselor and the Scout on what the Scout learned when reading their pre-req. The pre-req did a great job of applying each simple machine (lever, pulley, wheel/axle, included plane, screw, gears); consider bringing supplies so your discussion can involve the Scout physically manipulating the machines. You can find cheap kits online (https://www.educationaltoysplanet.com/simple-machines-physics-science-kit.html) that you might be able to give the Scout as a memorandum of their work on this award. Be sure to read Pages 76 – 79 of the Nova Guide; they will be helpful to you! There are some helpful videos that tie all the concepts together. Here is a 4th Grade Simple Machine project: https://www.youtube.com/watch?v=VunNpfdw68g , and of course if you have more time & didn't already do it in Requirement 1, there is always Bill Nye: https://www.youtube.com/watch?v=rN72X3Ss7ac .

Velocity = Distance divided by Time
Power = Work divided by Time
Distance = Velocity x Time
Time = Distance divided by Velocity
Force = Mass x Acceleration
Kinetic Energy = 1/2 mass x velocity squared
Potential Energy = Weight x Height

Requirement 3C1/2 requires the Scout to talk about how simple machines were involved in the Merit Badge they completed for this Award & how they got energy. Providing they finished their badge, this is easy—just consult page 80 of the Nova Guide! Similarly, the discussion about motion in 3C3 should be pro-forma.

This requirement should be covered in 20 – 40 min, depending how much hands-on and/or video technique you use. Ensure each Scout is fully participating!

4. This requirement requires identifying simple machines and forces in the practical environments of an Amusement Park or Playground. The requirement does require a visit, which would normally be done by the Scout as a family outing. If the Scout does not have family support or the opportunity to go on location, then get creative to "bring the park" to the Scout. The point is to use the mental education in the physical world. There are a number of websites that can help the Counselor prepare to talk about simple machines and forces in these environments. They range from simple concepts (http://www.learner.org/interactives/parkphysics/index2.html) to fuller(http://www.hometrainingtools.com/a/amusement-park-physics) and deluxe (http://www.physicsclassroom.com/class/circles/Lesson-2/Amusement-Park-Physics)

treatments. There is a nice syllabus for playgrounds (http://www.scholastic.com/teachers/lesson-plan/physics-playground).

Before you can discuss this topic with the Scout, you need to ensure they understand Forces and Motion (Push and Pull). Don't re-create college-level physics—keep it simple, and tailored to the age of your Scouts. If they are in Middle School, talk to the basics (http://easyscienceforkids.com/all-about-force-push-and-pull/). If the Scouts are in High School, then challenge them with excerpts from Khan Academy's classes on this subject (https://www.khanacademy.org/science/physics/forces-newtons-laws).

One of the toughest parts may be for the Counselor to figure out what kind of ride the Scout is trying to talk about. Drawing it may help, or consult lists of rides at Wikipedia (https://en.wikipedia.org/wiki/List_of_amusement_rides).

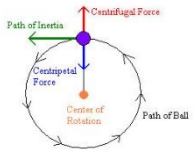


Figure 5www.hometrainingtools.com

Ride	Simple Machines	Forces
Coaster	Wheels/Axles, Pulley, Inclined Plane, Gears	Gravity, Inertia, Potential Energy, Kinetic Energy, Centripetal Force
Carousel	Wheels/Axles	Centripetal Force
Bumper Cars	Wheels/Axles	Newton's 1st Law (inertia), 2nd Law (mass vs speed), 3rd Law (reaction)
Free Fall	Pulley, Gears	Potential Energy, Kinetic Energy, Gravity
Pendulum	Lever,	Kintetic Energy, Potential Energy, Gravity
Slide	Inclided Plane	Gravity, Potential Energy, Kinetic Energy
Seesaw	Lever	Gravity

Spend about 30 – 60 minutes

5. It is quite likely that the Scout will have wound up accomplishing this requirement while working with the Counselor on Requirement 4! If not, it will be simple to accomplish this, referencing the preceding helps.

6. Spend about 5 – 10 minutes recapping the award by discussing this.

WHAT SUPPLIES ARE NEEDED / COSTS

1B/C: Potentially some physical magazines ($30). Vet the content before giving to a Scout!!
3A Graph Paper (http://www.amazon.com/Engineering-Computation-Letter-Sheets-35500/dp/B001J87JTM/ref=sr_1_1?s=office-products&ie=UTF8&qid=1442705860&sr=1-1&keywords=engineering+paper) $7 for 100 sheets
3A: Triangular Scale (http://www.amazon.com/Alvin-12-Inch-Architect-Triangular-110P/dp/B001DNHG64/ref=pd_sim_229_4?ie=UTF8&refRID=0FRF9RX64EQTMDSE3AG7&dpID=41wDrmNjXRL&dpSrc=sims&preST=_AC_UL160_SR160%2C160_) $6 Ea
3C/4/5: 6 Simple Machines Kit (https://www.educationaltoysplanet.com/simple-machines-physics-science-kit.html), $15

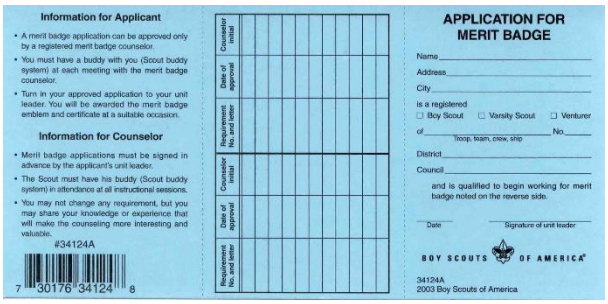
EXPECTED COSTS

If you were running 10 Scouts through this activity and had no cache of supplies, expect the cost to be about $247 ($25 Each). If you don't give Scouts the 6 Simple Machine Kit or the Triangular Scale, you can cut the total cost to about $40. Buy online, look at craft or teacher supply stores, drive over to SIUE and see what their STEM Center (http://www.siue.edu/stem/) will provide you. Scrounge!

TIME

Apart from reading this guide, preparing, purchasing, and the normal pleasantries, patience, and paperwork that counseling involves, expect this to require 75 – 135 minutes. If you break it up into multiple sessions and have multiple Scouts, be prepared for "clean up"—Scouts will rapidly diverge in their progress, and future sessions won't be as efficient as you hoped (they quickly become "individual" sessions).

HOW TO DOCUMENT PROGRESS AND COMPLETION


Information for Applicant
• A merit badge application can be approved only by a registered merit badge counselor.
• You must have a buddy with you (Scout buddy system) at each meeting with the merit badge counselor.
• Turn in your approved application to your unit leader. You will be awarded the merit badge emblem and certificate at a suitable occasion.
Information for Counselor
• Merit badge applications must be signed in advance by the applicant's unit leader.
• The Scout must have his buddy (Scout buddy system) in attendance at all instructional sessions.
• You may not change any requirement, but you may share your knowledge or experience that will make the counseling more interesting and valuable.
#34124A
7 30176 34124 8
Counselor initial
Date of approval
Requirement No. and letter
APPLICATION FOR MERIT BADGE
Name
Address
City
is a registered
☐ Boy Scout ☐ Varsity Scout ☐ Venturer
of Troop, team, crew, ship No.
District
Council
and is qualified to begin working for merit badge noted on the reverse side.
Date
Signature of unit leader
BOY SCOUTS OF AMERICA
34124A
2003 Boy Scouts of America

Officially, the Scout is responsible for keeping track of their progress. However, there is no official aid—like the Merit Badge Blue Card—for certifying which individual requirements the Scout has completed. It has become common for Councils to implement "unofficial" worksheets that each Scout uses (http://www.bsastemresources.com/uploads/8/4/7/7/8477978/wrksht_bs_engineering.pdf). Since these are unofficial, don't solely rely on them—BSA requirements change all the time! It can also be a problem if Scouts lose their worksheet between sessions. If the counselor wants to keep a personal record, either develop a spreadsheet or (after validating for currency) use Figure 4.

Please use the Advancement Report, No.34403, as documentation of completion for the Nova Award—see your unit Advancement Chair for assistance.

BSA Nova Whoosh! **Progress Record**

Scout *Printed* Name: _____

Unit of Scout: Troop _____ in BSA District: _____ in BSA Council: _____

ScoutMaster Approval *Signature* (for Scout to do this, with which Counselor): _____

Counselor *Printed* Name: _____

Requirement # and Letter	Date of Approval	Counselor Initial
1 (A, B, or C) 1		
1 (A, B, or C) 2		
2: Did which MB: _____	Date Earned:	
3A		
3B		
3C1		
3C2		
3C3		
4 (A or B) 1		
4 (A or B) 2		
5A		
5B1		
5B2		
6		

Note: In each requirement, circle which option was chosen. Stay consistent within the requirement!

ScoutMaster Acknowledgement of Completion: _____

Unit Advancement Chair Acknowledgement of inclusion in Unit Advancement Report: _____

Figure 6 Whoosh! Blue Card Surrogate

RECOGNITION

There are four steps to Scout Advancement (http://scoutmastercg.com/scout-advancement-a-scout-is-recognized/):

1. A Scout Learns
2. A Scout is Tested
3. A Scout is Reviewed
4. A Scout is Recognized

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Troop Committee Guidebook

Find fun ways to support these Scouting principles! For example, at the end of your award session, rather than just signing and handing over "Johnny did this" slips, make a big deal about presenting the Scouts with the vehicles they created in pursuit of the award, with personalized comments like "scariest roller coaster!". Get the paperwork back to the unit Advancement Chair along with a heads-up in advance so that the right Nova patch or pin is on-hand and can be presented to the Scout at the end of their next meeting. Attend the next unit Court of Honor and congratulate your charges after they get their formal recognition in front of their parents.

Finally, thank you for toiling harder than anyone knew in order to help Scouts become Engineers!

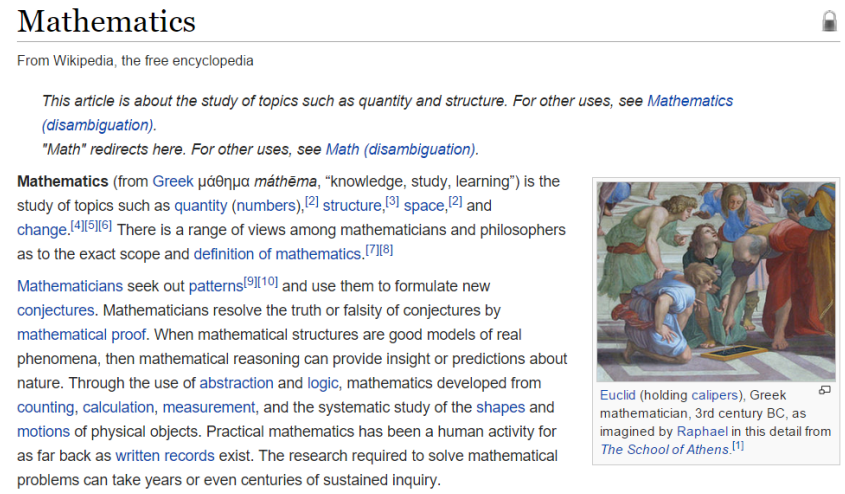
HELPFUL LINKS:

http://www.pbs.org/wgbh/nova/egypt/raising/lever.html
http://cnx.org/contents/50f7f0a0-3971-441a-9e38-28f7c5dc49ad@1/Simple-Machine-Elements
http://www2.phy.ilstu.edu/ptefiles/

http://www.constructionknowledge.net/general_technical_knowledge/general_tech_basic_six_simple_machines.php
http://electronics.howstuffworks.com/circuit-breaker2.htm
https://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_simple/cub_simple_lesson01.xml
https://www.khanacademy.org/science/discoveries-projects/simple-machines-explorations/a/simple-machines-and-how-to-use-this-tutorial

Designed to Crunch!

This guide doesn't tell you what you must do or how you must do it—it just helps speed you up if you decide to choose the easier path. However, I encourage you to explore the road less travelled!



Mathematics

From Wikipedia, the free encyclopedia

This article is about the study of topics such as quantity and structure. For other uses, see Mathematics (disambiguation).
"Math" redirects here. For other uses, see Math (disambiguation).

Mathematics (from Greek μάθημα *máthēma*, "knowledge, study, learning") is the study of topics such as quantity (numbers),[2] structure,[3] space,[2] and change.[4][5][6] There is a range of views among mathematicians and philosophers as to the exact scope and definition of mathematics.[7][8]

Mathematicians seek out patterns[9][10] and use them to formulate new conjectures. Mathematicians resolve the truth or falsity of conjectures by mathematical proof. When mathematical structures are good models of real phenomena, then mathematical reasoning can provide insight or predictions about nature. Through the use of abstraction and logic, mathematics developed from counting, calculation, measurement, and the systematic study of the shapes and motions of physical objects. Practical mathematics has been a human activity for as far back as written records exist. The research required to solve mathematical problems can take years or even centuries of sustained inquiry.

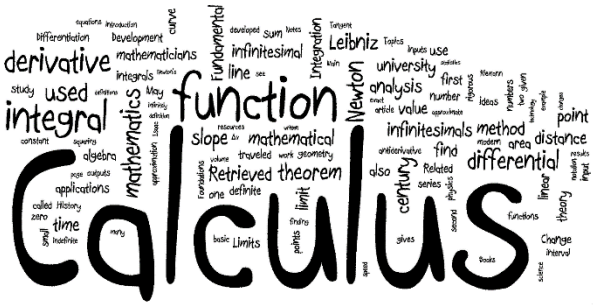
Euclid (holding calipers), Greek mathematician, 3rd century BC, as imagined by Raphael in this detail from *The School of Athens*.[1]

WHAT TO REVIEW FIRST

Familiarize yourself with the overview sections that opened this document.

You can get a "cliff-notes" version of what the Scout must do here: http://www.scouting.org/stem/Awards/BoyScouts.aspx#designedtocrunch .

Closely read the "Designed to Crunch!" section of the current Nova Guidebook Series. Searching online might find a PDF version of the full resource (http://www.sccbsa.org/docs/stem_scout_guidebook.pdf), but the BSA wants you to buy the current book from the Council Scout Store—check with the unit Librarian to see if the unit already owns a copy of the current version! Note: The links in the online one are live!



*** The information for this Nova award will appear in two different locations in the BSA Nova Guidebook. The first part is on pages 25 – 29 and states the requirements along with places to look for more information. The second part is on pages 81 – 87. This second part is meant for the counselor to use. At the beginning it is a near-duplicate of the earlier part—but by requirement 3A, the second section begins to provide additional explanatory information that the counselor will find helpful.

If you have time, Google "BSA STEM NOVA Designed to Crunch" and see what you find. Expand your search terms, and look for videos/etc. The Greater St Louis Council (GSLAC) has perhaps the best / biggest BSA STEM program in the country—don't neglect reviewing it (http://stlbsa.org/activities/other-activities/stem/)!

This Award has more choice for the Scout than the others!

HOW TO PRESENT

> CAUTION: One of the complications of the Nova requirements is that there is a high amount of choice—this was done so Scouts could pick what interested them personally. However, if presenting this in a small group setting, the counselor will probably have to personally choose which alternative requirements will be done. If so, make this clear from the onset so there aren't upset parents who want Johnny to do something you aren't prepared to support.

Pre-Requisites:

Given that caution, there are parts of this award that the Scout could best do at home:

1. *Researching* or Reading or Watching and developing questions (requirements 1A / 1A1, 1B / 1B1, or 1C / 1C1, or 1D / 1D1) are great pre-reqs. A great crypto resource for Scouts who are over 12, have a current Cyber Chip ( ), and their parents' permission is Khan Academy's Cryptography Class (https://www.khanacademy.org/computing/computer-science/cryptography/crypt/v/intro-to-cryptography).

2. Accomplishing one of the listed Merit Badges is a great pre-req. If counseling this award as part of a larger STEM event, consider offering some of these merit badges in morning sessions, then offer the Nova awards in the afternoon sessions. Caution: STEM merit badge requirements can be very substantial, and to meaningfully accomplish them, it may require 6+ hours of counseling (with pre-reqs).


Boy Scouts of America > Guide to Advancement 2015 > The Merit Badge Program

The Merit Badge Program

7.0.0.1 The Benefits of Merit Badges

There is more to merit badges than simply providing opportunities to learn skills. There is more to them than an introduction to lifetime hobbies, or the inspiration to pursue a career—though these invaluable results occur regularly. It all begins with a Scout's initial interest and effort in a merit badge subject, followed by a discussion with the unit leader or designated assistant, continues through meetings with a counselor, and culminates in advancement and recognition. It is an uncomplicated process that gives a Scout the confidence achieved through overcoming obstacles. Social skills improve. Self-reliance develops. Examples are set and followed. And fields of study and interest are explored beyond the limits of the school classroom.

3. Scouts have to pick two from five choices. If you don't downselect the options in advance, it will make it hard to counsel a group of Scouts through this in a group setting…however, that eliminates choice for the Scout, and therefore potentially their personal engagement.

If they select the Personal Horsepower exercise, make sure they know to follow the method shown in http://www.wikihow.com/Calculate-Horsepower!

The track/run/swim exercise will take time to complete because at least two meets must be covered—encourage Scouts to get this done early! The remaining sports-related exercises require significant attention from the Scout! To make it easier on the Scout and the Counselor, example templates are provided on the following tables to aide in capturing the right data.

The Star Count exercise will also require five clear nights from a dark location at the same time each evening—that may be hard for the Scout to do, given the dependence on family for transportation…be sure the Scout follows the instructions, recreated below since NASA ended their educational site that the guidebook says to use.

********** Cached Copy of
http://www.nasa.gov/audience/foreducators/son/energy/starcount/Count_the_Stars.html

Count the Stars

Now that you've completed the instructions at Prepare for Your Star Count, you are ready to go out and perform the Star Count activity. The Star Count activity should be done on a clear night. It is best to have no clouds. A few scattered clouds are all right if you use only clear parts of the sky for the Star Count.

Important: Allow your eyes to become "dark-adapted." Go outside to the darkest spot you can find and wait for at least 20 minutes before you begin this activity. This waiting time allows your eyes to be at their most sensitive to the faint light of stars.

Safety Warning: Do this activity with an adult. Don't go into a dark spot unless you know it is safe. Use a flashlight when walking in the dark.

Figure 7 Once your preparations are complete, you are ready to start counting stars! Image Credit: NASA

Start Counting

It is impossible to count every star in the night sky. The method you will use will allow you to get very close to the actual number. This method is like those used in surveys. Imagine that you want to find out how many of the students in your school would support a longer school day. It would be very difficult to ask every student in a large school. Your friends' opinions probably wouldn't represent all of the students accurately. If you stood at the door of your cafeteria and asked every 20th student, you could probably get an accurate survey. At a very big school, you might choose every 30th student. Each student was chosen at random (by chance) to help your survey represent everyone.

To count the stars you will choose 10 parts of the sky at random (by chance) and count the stars. Then you will find the average number of stars counted in each observation. (For example, if you observed zero stars in one count and 100 stars in another count, the average is 50 stars per count.)

But, the *average* number of the stars per count isn't the same as the *total* number of stars in the sky! Imagine that the average number of stars per count is 50. What fraction of the sky did you observe each time? If you observed 1/10th of the sky each time, then there are about 500 stars (10 times 50). If you observed 1/100th of the sky in each observation, there are about 5,000 stars (100 times 50).

The Star Count Data Sheet has a box where you can calculate the total number of stars. The equation uses the average count per observation and the fraction of the sky you can see through your tube. This calculation uses the length and radius of your viewing tube. (Why does the fraction of the sky you can see depend on the length and radius of the tube? Can you think of an experiment to prove the amount of sky you can see does depend on length and radius of the tube?)

1. Point the Star Count viewing tube at a random (chance) point in the sky. Close one eye. Hold the end of the tube up to your open eye. Count the number of stars that you can see through the tube. If you see no stars through the tube, you must count zero. Don't move the tube to look for stars. (Of course, if you are looking at a house, trees, a hill, cloud or anything but clear sky, you can point the tube in a different direction.)
2. Record the number of stars you counted on your printed copy of the Star Count Data Sheet. Use the line after "Star Count 1" in the Record Observations section.
3. Repeat procedures 1 and 2 nine more times, for a total of 10. Point your viewing tube at a different location in the sky. Make sure that you choose the direction at random (by chance) again. Do not move the tube to see more stars or to select brighter stars. Do not count when looking at anything but clear sky. Record the number of stars you count each time on your data sheet. Use the lines after "Star Count 2" through "Star Count 10."
4. Find the total number of stars you saw. Record this number in the TOTAL blank on the Star Count Data Sheet.
5. Find the average number of stars. Record this number in the AVERAGE blank on the Star Count Data Sheet.
6. Measure the distance, in meters, from the nearest security light, street light or other bright light (if less than 50 meters). Record the distance on the Star Count Data Sheet.

Calculate Star Count

1. The Star Count Data Sheet has a box where you may calculate the total number of stars you can see in the sky.
2. The first line has an equation. This equation allows you to turn the average of your 10 random counts into a number that is a very good approximation of the total number of stars you can see.
3. The third line repeats the equation with empty lines for l, r and AVERAGE. Write in the values of the viewing tube length (l), tube radius (r), and the AVERAGE of all 10 Star Count observations into the correct boxes of the equation.
4. Solve the equation with your values of l, r and AVERAGE. This number is the Star Count number for your Star Count site on the date you performed your observations. Be sure to double-check your math for errors.

Figure 8 Be sure to double-check your math for errors! Image Credit: NASA

Enter Data Online

Now you can enter your data online for students everywhere to use. Check to see that you have entered data into all boxes for which you have data.

When all of the data are entered, click the Add Data button at the bottom of the Star Count Data page. You have just entered your Star Count Site Data into a database that can be viewed worldwide.
Enter Data Online → [THIS SITE IS DEAD]

Figure 9 Star Count investigators from around the globe can use this data. Image Credit: NASA

Investigation: Do people everywhere see the same number of stars in the night sky? Why or why not?

Doing your own Star Count is only the beginning. Research other students' observations to answer the questions above. Information about the location of observations may be helpful. Use all available information. Why might other students report a different number of stars?
View Other Student Data →[THIS SITE IS DEAD]

Find this article at: http://www.nasa.gov/audience/foreducators/son/energy/starcount/Count_the_Stars.html

Star Count Data Sheet

Date of observation _____ (mm/dd/yyyy) (example: 08/20/2006)

Latitude _____ (xx.xx in degrees) (example: 45.00°)

Longitude _____ (xxx.xx in degrees) (example: 110.70°)

Elevation _____ (in meters)

Cloud cover _____ (estimate cloud cover and round to the nearest 0%, 25%, 50%, 75% or 100%)

Air pollution index _____

Distance from security/street light _____ (in meters)

Star Count Viewing Tube

Length (l) _____ cm

Diameter (d) _____ cm

Radius (r) _____ cm

Record Observations

Star Count 1 _____
Star Count 2 _____
Star Count 3 _____
Star Count 4 _____
Star Count 5 _____
Star Count 6 _____
Star Count 7 _____
Star Count 8 _____
Star Count 9 _____
Star Count 10_____

TOTAL _____

AVERAGE _____

Calculate Star Count

$$\text{Star Count} = \frac{2l^2}{r^2} \times \text{AVERAGE}$$

$$\text{Star Count} = \frac{2 \times l \times l}{r \times r} \times \text{AVERAGE}$$

$$\text{Star Count} = \frac{2 \times \_ \times \_}{\_ \times \_} \times \_\_\_\_\_$$

Star Count = _____

****

Requirement 3B Form: Attend at least two track, cross-country, or swim meets

Event Date:		Event Type:	
Racer 1 Time	**Racer 2 Time**	**Racer 3 Time**	**Average Time**
Fastest Time of top racer in event:			

Event Date:		Event Type:	
Racer 1 Time	**Racer 2 Time**	**Racer 3 Time**	**Average Time**
Fastest Time of top racer in event:			

For Both Events:			
Racer 1 Average	**Racer 2 Average**	**Racer 3 Average**	**Events Average Time**

Compare the racers to each other. Explain:

Compare the racers to the best racer in the event. Explain:

Compare each racers performance among events. Explain:

What are the strengths and weaknesses of each runner? Explain:

Requirement 3C Form: Attend a soccer, baseball, softball, or basketball game.

Soccer:

Event Date:			Soccer Opponents:			
Players	**# Goals**	**# Assists**	**# Corner Kicks**	**# Keeper Saves**	**# Fouls**	**# Offsides**
Player 1:						
Player 2:						

Baseball or Softball:

Event Date:			Opponents:			
Players	**# At-Bats**	**# Hits**	**Batting Avg**	**# Runs**	**# Fielded Balls**	**# Pitches**
Player 1:						
Player 2:						

Basketball:

Event Date:			Opponents:			
Players	**# Points Scored**	**# Baskets Attempted**	**# Rebounds**	**# Steals**	**# Turnovers**	**# Blocked Shots**
Player 1:						
Player 2:						

What are your conclusions about each players strengths and weaknesses? Explain

Requirement 3D Form: Keep track of a football team during a game.

Event Date:			Opponents:				
Qtr	Offense			Defense			
	# 1st Downs	Forward Passes	Running Plays	# Qbk Sacks	# Intercptn	# Turnovers	# safeties
1		Attempted: % completed: TTL Length of passes: Longest Pass: # caught/distance: Yardage gained:	# Yards gained (lost): Longest run: TTL yards gained (lost): # TD's:				
2		Attempted: % completed: TTL Length of passes: Longest Pass: # caught/distance: Yardage gained:	# Yards gained (lost): Longest run: TTL yards gained (lost): # TD's:				
3		Attempted: % completed: TTL Length of passes: Longest Pass: # caught/distance: Yardage gained:	# Yards gained (lost): Longest run: TTL yards gained (lost): # TD's:				
4		Attempted: % completed: TTL Length of passes: Longest Pass: # caught/distance: Yardage gained:	# Yards gained (lost): Longest run: TTL yards gained (lost): # TD's:				

What are your teams strengths and weaknesses? Explain:

4. The Scout needs to become familiar with a scientific calculator. However, Scouts in middle school are unlikely to own one. To preclude a Scout just showing simple addition, suggest that if they do not own a graphing scientific calculator (or app), then to become familiar with a free on online (like http://web2.0calc.com/). The point is not for the Scout to learn advanced math functions, but to experiment and see what they discover in the process of learning how the calculator works.

5. This requirement would be best done in the presence of the counselor.

In the presence of a counselor

Some examples include—but are not limited to—shows found on PBS ("NOVA"), Discovery Channel, Science Channel, National Geographic Channel, TED Talks (online videos), and the History Channel. You may choose to watch a live performance or movie at a planetarium or science museum instead of watching a media production. You may watch online productions with your counselor's approval and under your parent's supervision. One example is the NOVA Lever an Obelisk page on ancient Egypt and the use of levers, available at www.pbs.org/wgbh/nova/egypt/raising/lever.html.

Examples of magazines include—but are not limited to—*Odyssey, Popular Mechanics, Popular Science, Science Illustrated, Discover, Air & Space, Popular Astronomy, Astronomy, Science News, Sky & Telescope, Natural History, Robot, Servo, Nuts and Volts,* and *Scientific American.*

1. To have the most control over this requirement in order to have the best quality discussion, the counselor would pre-select items for the Scout to read and watch on their own. However, in practice this is a hard thing to do. Also, Scouts are much more likely to watch videos for three hours than read for three hours! This Award is unique because of it's "Research" option—try to steer the Scout toward that elective. Selecting online videos is tough because it presumes Scout access to the Internet. However, you can find some interesting ones in this category that may keep the interest of a Scout (https://www.khanacademy.org/computing/computer-science/cryptography/crypt/v/intro-to-cryptography). It is best to point the Scout to the list of helpful sources shown in the Nova Guidebook and have them select what to watch/read. If you have some of the magazines listed as potential reading, offer to lend one or two to the Scout for them to review. When the Scout meets with you again, find out what they watched/read, what it was about, what they learned, and why they picked that item. Unless they picked the Research Elective, look at their written-out questions and pick the two that you are most able to talk to, asking them to present their question and helping them find an answer. Be sure to help them understand what the practical applications might be. Hint: you may want to have a smartphone or computer handy! If they did the Cryptography research topic, review their notes and discuss with them. Perhaps see if they can pass a simple cipher to you—try to make it fun; perhaps via a scytale using your walking stick and a strip of paper (https://en.wikipedia.org/wiki/Scytale). Spend 10 – 15 minutes on this.

2. Determine which merit badge the Scout earned and document that because the same merit badge can't be claimed multiple times in the Nova and SuperNova awards system. Unless you already counsel that merit badge, you may find it helpful to pull up a copy of the merit badge requirements / worksheet from sources like http://meritbadge.org/wiki/index.php/Merit_Badges . Find out what the Scout found interesting about that badge, then ask how engineering was used in the badge. 10 mins.

3. There is a lot of choice on the part of the Scout to accomplish this requirement, and the quality of their pre-req actions is critical to successful completion—consider meeting with them before they do the pre-reqs, see which * TWO * they will work with, then mentor them on the

right technique and give them the forms as helps. Consider ROC [Rehearsal of Concept] Drills: playing a short snippet of video of the kind of sport activity that they will chart and work with them to record what happens during that short segment. It should make for a better learning experience.

Requirement 3A: Review their work and ensure it conforms to the manual's approach on Page 83 and the calculations are correct. Have a smartphone so you can look up stats like the horsepower of their favorite car.

When considering **human**-powered equipment, a healthy **human** can produce about 1.2 **hp** briefly (see orders of magnitude) and sustain about 0.1 **hp** indefinitely; trained athletes can manage up to about 2.5**hp** briefly and 0.3 **hp** for a period of several hours.

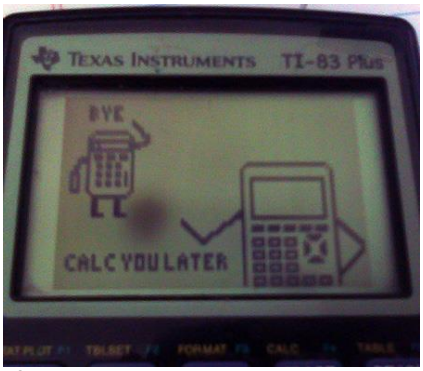
Horsepower - Wikipedia, the free encyclopedia
https://en.wikipedia.org/wiki/**Horsepower**

Requirement 3B, 3C, 3D. Review the Scout's documented data. Discuss how it went, what they learned, what they might do differently next time. If the Scout is really into Sports and Statistics, consider showing them a video on why analyzing Sports data is worth big money: https://www.youtube.com/watch?v=KM-DJjx4S3I . If they are over 13 and their parents approve, suggest they watch the Moneyball movie: http://www.imdb.com/title/tt1210166/ . A similar movie, fit only for adults, is Draft Day: http://www.imdb.com/title/tt2223990/ .

Requirement 3E: Be sure to check out your helps on Page 86 of the Nova Guide. Look around the local area for organizations that may already have Star Counting programs that the Scout can participate in. Examples here include the St Louis Astronomical Society (http://nightsky.jpl.nasa.gov/club-view.cfm?Club_ID=718), McDonnell Planetarium (http://www.slsc.org/planetarium), Washington University Crow Hall (http://www.riverfronttimes.com/stlouis/best-place-to-stargaze/BestOf?oid=2508042), UMSL (http://saintlouis.kidsoutandabout.com/content/university-missouri-st-louis-observatory), or Challenger Learning Center (Their website is currently hacked; call them instead at (314) 521-6205 or visit them at 205 Brotherton Ln, St. Louis, MO 63135.

NOTE: It isn't possible to report their results to NASA anymore; NASA discontinued their educational support program due to budget cuts. Instead, mail the results to your Congressman.

This requirement should be covered in 15 – 30 min, depending how much discussion and/or video technique you use. Ensure each Scout is fully participating!



4. Be sure to check out your helps on Page 87 of the Nova Guide. See what the Scout can demonstrate to you from what they learned. Walk them through using various features and functions on a calculator. Demonstrate how different types of calculators work (i.e., Reverse Polish Notation, etc: http://jcflowers1.iweb.bsu.edu/rlo/mathcalculatortypes.htm) Talk about when you might use a computer (spreadsheet, etc) rather than a calculator. Show them an example of a sophisticated spreadsheet—perhaps for accounting for costs of a Scout trip.

Spend about 10 – 20 minutes

5. Spend about 5 – 10 minutes recapping the award by discussing this.

WHAT SUPPLIES ARE NEEDED / COSTS

1B/C/D: Potentially some physical magazines ($30). Vet the content before giving to a Scout!!

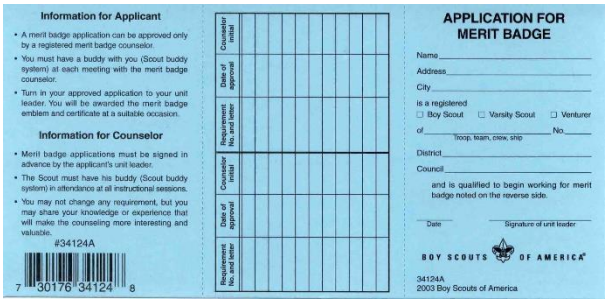
EXPECTED COSTS

If you were running 10 Scouts through this activity and had no cache of supplies, expect the cost to be about $30 ($3 Each). You can find most of what you need to do this Award online—or scrounge!

TIME

Apart from reading this guide, preparing, purchasing, and the normal pleasantries, patience, and paperwork that counseling involves, expect this to require 60 – 85 minutes. If you break it up into multiple sessions and have multiple Scouts, be prepared for "clean up"—Scouts will rapidly diverge in their progress, and future sessions won't be as efficient as you hoped (they quickly become "individual" sessions).

HOW TO DOCUMENT PROGRESS AND COMPLETION



Officially, the Scout is responsible for keeping track of their progress. However, there is no official aid—like the Merit Badge Blue Card—for certifying which individual requirements the Scout has completed. It has become common for Councils to implement "unofficial" worksheets that each Scout uses (http://www.bsastemresources.com/uploads/8/4/7/7/8477978/wrksht_bs_math.pdf). Since these are unofficial, don't solely rely on them—BSA requirements change all the time! It can also be a problem if Scouts lose their worksheet between sessions. If the counselor wants to keep a personal record, either develop a spreadsheet or (after validating for currency) use Figure 10.

Please use the Advancement Report, No.34403, as documentation of completion for the Nova Award—see your unit Advancement Chair for assistance.

BSA Nova Designed to Crunch! **Progress Record**

Scout *Printed* Name: _____

Unit of Scout: Troop _____ in BSA District: _____ in BSA Council: _____

ScoutMaster Approval *Signature* (for Scout to do this, with which Counselor): _____

Counselor *Printed* Name: _____

Requirement # and Letter		Date of Approval	Counselor Initial
1 (A, B, C or D) 1			
1 (A, B, C or D) 2			
2: Did which MB: _____		Date Earned:	
Pick Two:			
	3A(1)		
	3A(2)		
	3B(1)		
	3B(2)		
	3B(3)		
	3C(1)		
	3C(2)		
	3C(3)		
	3D(1)(a)		
	3D(1)(b)		
	3D(1)(c)		
	3D(1)(d)		
	3D(2)(a)		
	3D(2)(b)		
	3D(2)(c)		
	3D(3)		
	3E(1)		
	3E(2)		
	3E(3)		
4A			
4B			
5			

Note: In each requirement, circle which option was chosen. Stay consistent within the requirement!

ScoutMaster Acknowledgement of Completion: _____

Unit Advancement Chair Acknowledgement of inclusion in Unit Advancement Report: _____

Figure 10 Designed to Crunch! Blue Card Surrogate

RECOGNITION

There are four steps to Scout Advancement (http://scoutmastercg.com/scout-advancement-a-scout-is-recognized/):

1. A Scout Learns
2. A Scout is Tested
3. A Scout is Reviewed
4. A Scout is Recognized

When a Scout advances, he should be recognized as soon as possible–preferably at the next unit meeting. He is recognized a second time at a public ceremony called a court of honor. The main purposes of the court of honor are to furnish formal recognition for achievement and to provide incentive for other Scouts to advance. Formal courts of honor should be conducted at least four times a year. All Scouts who have advanced since the previous court of honor are honored. Their parents and friends should be invited to attend the ceremony. Suggestions on court of honor agendas and ceremonies are found in Troop Program Resources for Boy Scout Leaders.

Troop Committee Guidebook

Find fun ways to support these Scouting principles! For example, at the end of your award session, rather than just signing and handing over "Johnny did this" slips, make a big deal about presenting the Scouts with the vehicles they created in pursuit of the award, with personalized comments like "Highest Horsepower!". Get the paperwork back to the unit Advancement Chair along with a heads-up in advance so that the right Nova patch or pin is on-hand and can be presented to the Scout at the end of their next meeting. Attend the next unit Court of Honor and congratulate your charges after they get their formal recognition in front of their parents.

Finally, thank you for toiling harder than anyone knew in order to help Scouts become Mathematicians!

HELPFUL LINKS:

http://people.math.umass.edu/~gunnells/talks/crypt.pdf
http://www.wikihow.com/Calculate-Horsepower
http://onlinephys.com/labpower1.html
http://www.baseballscorecard.com/downloads.htm
http://www.ehow.com/how_4451141_take-statistics-basketball-game.html
http://www.globeatnight.org/
http://www.windows2universe.org/
http://darksky.org/
http://www.darkskiesawareness.org/
http://www.nasa.gov/offices/education/about/index.html
http://www.nasa.gov/pdf/145989main_StarCountDataSheet_v4a.pdf