



NARTREK

Gold Achievement Level

HOW TO USE THIS PACKET

This online copy of the NARTREK Gold Achievement Level packet is for information only. Unlike our online Bronze packet, the Gold Level is not part of our special NARTREK promotion, and cannot be earned without preregistration. In addition, the actual Gold packet includes a copy of Centuri Technical Information Report TIR-33 on rocket stability.

Complete information on our special promotion is contained in our Bronze Level packet.

Start on your NARTREK Bronze Level today!



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Welcome to the NARTREK Gold!

Congratulations on achieving the Silver Level! Your hard work has paid off and now you can begin the last step: achieving Gold.

The Gold Level is very different from the other levels. Instead of flying rockets designed by others, you will design, build and fly your own rocket. The Gold Level is therefore more technical, and more mathematically difficult. This is not an easy Achievement Level, but it can be done, because others have done it.

We have enclosed a special collector's item in this packet. We have found a supply of original copies of TIR-33 from Centuri. This report, written by Jim Barrowman in 1975, set the basis for workable analysis of model rockets. We are proud to be able to provide our Gold rocketeers the original report!

While computer programs are available to help you with this level, we recommend that you study TIR-33 carefully so you will understand what the programs are doing.

The best place to find rocket software is at <http://www.rocketryonline.com>. There you will find Digitrak and WinRASP, to predict performance, and VCP, to help determine the center of gravity and the center of pressure of your rocket. You will need to do some studying, but we are here to help you if you need it.

Complexity, beauty, and size of your design are not factors and are not considered. Your objective is to build a successful model rocket that will perform in a predictable fashion. This is an engineering project where you must use available information to design a device that works as predicted.

Unlike the other levels, you are not restricted in motor size. We recommend you use smaller motors for your initial flights—but you now have enough expertise and experience to know what motors to use. Please remember that all flights must be returned and all flights must take place after you receive this packet to count. Be sure all of the forms are completely filled out and signed.

If you have any questions or problems please feel free to write, call or e-mail NARTREK Base. We are here to help you. We will answer by return mail or e-mail as quickly as we can.

National Association of Rocketry Training Rocketeers for Experience and Knowledge



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When you achieve this level, you will be able to design and build safe, predictable rockets. You will understand why rockets perform as they do, and how to make them perform better. You will be a master rocketeer! Good luck!

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Requirements

1. Design your own model rocket. It may be a sport, contest or payload model. Compute the Center of Pressure (Cp) using the Barrowman Method or calculate the Cp using one of the available computer programs. Estimate the Center of Gravity of your model with the largest expected rocket motor installed. Evaluate the static stability of your model. Compute the predicted altitude of your design, assuming various drag coefficients (CD). You may do this using the Centuri Report TIR-100 or Estes TR-10 and TR-11, or you may use one of the commercially available or freeware programs available on the Internet.
2. Build and fly your rocket design. Determine the altitude to which it flies by using standard tracking system methods or by use of an on-board altimeter. You may also use a stop-watch and the drop-streamer method described in *Handbook of Model Rocketry*, Chapter 17, by G. Harry Stine. Make at least three (3) flights with each of at least two (2) types of motors and compute the average altitude achieved for each motor type. This is a minimum of at least six (6) flights. Using this data and your previous flight performance calculations, estimate the actual drag coefficient of your model. Record the flight information and the results of your calculations on the Flight summary Sheet that came with your Gold packet. Be sure to complete the comparison of predicted to actual performance.
3. Submit the Requirement Certification sheet completely filled out. Take a photograph of your model and attach it to the certification sheet. Also attach a dimensioned drawing of your model showing all dimensions necessary to allow someone else to build your design from this drawing. Attach the center of pressure calculations, flight performance calculations, and flight performance data for your design. Neatness and thoroughness counts. If NARTREK Base cannot read or decipher your work sheets and data, they will be returned to you for re-work. If NARTREK Base finds the data incomplete, your submission will be returned.

Do not send individual requirement certification sheets to NARTREK BASE! Wait until you have completed all four requirements before submitting your documents. Be sure to submit complete documentation for all requirements as well as the Requirements Certification sheet and photograph.



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Requirements Certification Sheet

I hereby certify that I have designed, constructed, and flown the enclosed model rocket design. I have attached the following data:

1. Dimensioned drawing of the model design.
2. Calculation of the Center of Pressure of my design.
3. Center of Gravity measurements and stability calculations.
4. Calculated altitude performance of the model assuming different values of drag coefficient.
5. Actual altitude performance data, recorded on the *Flight Summary Sheet*.
6. A description of the method(s) used to obtain altitude measurements.
7. Determination of the probable drag coefficient using flight data compared against calculated performance data.
8. Photograph of the completed model.

Signed: _____ Date: _____

Print Name: _____ NAR #: _____

ATTACH PHOTO OF MODEL BELOW



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Flight Summary Sheet

Description of Model

Name of Model	Length (cm)	Max. Diam. (mm)	CP Location (cm)	Empty Mass (gm)

Flight Summary for Motor Type: _____

Date	Temp (C or F)	Total Liftoff Mass (gm)	Measured Altitude (m)	Measured CG Location (cm)	Comments

Average Altitude for Above Flights (m): _____

Calculated C_D for Above Flights: _____

Flight Summary for Motor Type: _____

Date	Temp (C or F)	Total Liftoff Mass (gm)	Measured Altitude (m)	Measured CG Location (cm)	Comments

Average Altitude for Above Flights (m): _____

Calculated C_D for Above Flights: _____

Average C_D for both motor types: _____

Comments: