Richard Nakka's *Experimental Rocketry* Web Site

Rocketry Software

SRM.XLS
Solid Rocket Motor Design

This MS EXCEL spreadsheet was originally written in order to assist in the design of the Kappa series of rocket motors. As it proved to be quite useful and gave good correlation to actual test results, I decided to enhance the spreadsheet and make it available on this web site (originally as a beta version). Based upon user inputted motor and grain geometry data, the spreadsheet computes Kn over the duration of the burn, generates a pressure-time curve, a thrust-time curve, as well as performance parameters such as total impulse and delivered specific impulse. Motor performance data is also summarized for easy input into a trajectory simulation software, such as SOAR. Although primarily intended for designing motors using KN-Dextrose or KN-Sorbitol propellant, other propellants may be specified with user inputted propellant properties.
Solely for cylindrical grain configurations, such as BATES.
Written by R.A. Nakka.

SRM.ZIP Version: 1.00 536 kbytes Zipped EXCEL 2000 spreadsheet Freeware
SRM_RU.ZIP Russian Language Version 1.08 Mbytes Zipped EXCEL 97/2000
SRM-CASTELLANO.ZIP Spanish Language Version 550 kbytes Zipped EXCEL

CASING.XLS
Motor Casing Design

This is an MS EXCEL spreadsheet that is used to determine the Design Pressure and Burst Pressure of a solid rocket motor casing. Also determines the elastic deformation of the casing under pressure (important for case-bonding consideration). Strength and mechanical properties are supplied for many casing materials such as steels, aluminum alloys, PVC, etc.
Written by Richard Nakka.

CASING.XLS Version 1.03 61kbytes EXCEL 5.0 spreadsheet Freeware

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IGNITER.XLS
Rocket Motor Igniter Design

This is an MS EXCEL spreadsheet that may be used to estimate the chamber pressure that occurs in a rocket motor due to combustion of a pyrotechnic igniter. Use of a properly sized pyro igniter is important for efficient rocket motor design. The motor should reach full operating pressure rapidly without wasting propellant (and thereby reducing Isp). As well, it is important to avoid overpressurization. Although tailored for black powder igniters, this spreadsheet may be used for other pyrotechnic mixtures, as well. The latest version of this spreadsheet (v1.1) also computes parachute ejection charge force.
Written by Richard Nakka.

IGNITER.XLS Version 1.1 74kbytes EXCEL 2000 spreadsheet Freeware

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CONVERT
Units Converter

Windows software that converts units for Force, Pressure, Density, Area, Distance, Volume and several other measures. Very convenient and simple to use, highly recommended. Written by Joshua F. Madison. Available for

download at Joshua's web site www.joshmadison.com/soft , or download it here:

CONVERT.ZIP Version 4.08 168 kbytes Zipped file Freeware

EzAlt
Rocket Flight Performance Spreadsheet

An easy to use Excel spreadsheet that predicts the peak altitude, maximum velocity, burnout altitude, acceleration and time to peak altitude of an amateur rocket. Intended primarily as a rocket design aid due to its simplicity of use and ease with which variables (such as rocket mass, motor output, drag coefficient, etc.) can be modified, and the effects of such studied. Both English and Metric units. Written by Richard Nakka.

EzAlt.xls Version 1.2 195kbytes EXCEL 97 spreadsheet Freeware

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SOAR
Rocket Flight Performance

This program predicts the flight performance of a rocket. It calculates parameters such as altitude, velocity, acceleration, drag force, dynamic pressure, Mach number, and is capable of handling single-stage, multi-stage and clustered rockets. Meant to be accurate, the program utilizes efficient professional subroutines for numerical differentiation and integration. Also meant to be versatile and user friendly, it can handle supersonic rockets with a flight ceiling to 100,000 feet. as easily as low altitude model rockets with commercial engines. Runs under DOS only. Written by Richard Nakka & B.W. Nakka.

SOAR.ZIP 187 k DOS Freeware

Data files of Model Rocket Engines, for use with SOAR program.
MROCKENG.ZIP 15 k

Data files of the Kappa-DX & Kappa-SB Rocket Motor, for use with SOAR program. KAPPA.ZIP 2 k

Data files of the B-200 & C-400 Rocket Motors, for use with SOAR program. ENGINE1.ZIP 1 k

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WHOOSH
Water Rocket Performance

This program may be of interest to the slightly less adventurous amateur rocketeer -- it predicts the performance of a "soda bottle" rocket (aka "water rocket"). A *water bottle rocket*, by the way, is a rocket made from a plastic soda bottle (eg 2 litre) filled with a mixture of water and compressed air (surprising performance!).

Program calculates parameters such as thrust, jet velocity, and pressure, all as a function of time, as well as total impulse and specific impulse. May be used together with SOAR to predicts the flight performance.
Runs under DOS only. Written by Richard Nakka.

Source code (FORTRAN) is available upon request.

WHOOSH.ZIP 37k MSWORD 6.0 documentation DOS Freeware

ROCCAD
Rocket Altitude Prediction
& Coefficient of Drag and Centre of Pressure Estimation

This program predicts the altitude a rocket may fly given the performance parameters of the motor and the physical characteristics of the rocket. The program also determines the optimum weight of a rocket to achieve maximum altitude. Additionally, the program can estimate the coefficient of drag (Cd) and the centre of pressure (Cp) of a rocket, based on the rocket's geometry. Includes performance parameters for the PVC "G", "H", & "I" rocket motors.
Runs under DOS only. Written by: Charles D. Knight.

ROCCAD.ZIP 169 k DOS Freeware

AEROLAB
Rocket Drag and Stability

Aerolab is a very useful and easy to use package that estimates Drag, Lift and Center of Pressure for rockets flying at velocities up to Mach 8. It also estimates the rockets Center of Gravity and Moments of Inertia and performs stability analysis within the entire velocity range.
Runs under 32 bit Windows. Written by Hans Olaf Toft.

AEROLAB1_2.ZIP MS Windows For free distribution 389 kb

GUIPEP

Graphic Interface for PROPEP program

This program provides a user friendly interface to run the PROPEP propellant evaluation program. PROPEP is a program that determines the chemical equilibrium composition for the combustion of a solid or liquid rocket propellant. Additionally, it determines rocket performance parameters such as Isp and C*, and nozzle design parameters.
Runs under Windows. Written by Arthur J. Lekstutis, GUIPEP is available for download at Arthur's web site, which also has a link to PROPEP.

GUIPEP and PROPEP MS Windows For free distribution

ProPep 3 by Dave Cooper, 2012 MS Windows 7 For free distribution NEW

Expanded data file (pepcoded.daf) for the PROPEP program. Includes entries for **Dextrose, Sorbitol, Mannitol, Xylitol, Charcoals, Asphalt, Paraffin and others.**
April 2010 pepcoded.zip Zipped text file 23 kb

For details on using GUIPEP and an explanation on interpreting the output, see my web page:
Solid Rocket Motor Theory -- GUIPEP

THERMCAS
Motor Casing Thermal Analysis

A thermal analysis package that determines the temperature distribution through the thickness of a motor casing wall that results from convective heating due to propellant combustion and resulting gas flow. The package consists of DOS executable file which outputs a table of results which may be copied into a companion EXCEL spreadsheet for plotting. In addition, the spreadsheet contains thermal and material properties required as input data, as well as a calculator for determining the required heat transfer convection coefficient.
Runs under DOS only. Written by Richard Nakka.

THERMCAS.ZIP 112k DOS Freeware Version 1.01

PARAPAT.XLS
Parachute Gore Pattern Maker

This MS EXCEL spreadsheet may be used to create a flat pattern for a parachute *gore*. A gore is an individual panel that, when stitched together

with adjacent gores, forms the canopy of a parachute. The user inputs the basic parachute diameter, as well as the number of gores desired (minimum of 4). The spreadsheet creates a table of coordinates as well as a plot of a single gore. When assembled, the parachute canopy is *semi-ellipsoidal* in shape (a "flattened" hemisphere). This form of canopy is more efficient than a hemispherical canopy, in that less material is required to provide equal drag.
Written by Richard Nakka.

PARAPAT.XLS Version 1.00 42kbytes EXCEL 97spreadsheet Freeware

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LOADCELL.XLS
Loadcell Designer

A relatively simple-to-make beam-type loadcell may be designed by use of this Excel spreadsheet. The user specifies the dimensions of the loadcell body (basically, a rectangular block of metal) and the size of hole to be drilled through the body, in order to achieve the desired load capacity. The only other materials required are one or two strain gages, and suitable adhesive for mounting such.
Written by Richard Nakka.

LOADCELL.XLS Version 1.10 210 kbytes EXCEL spreadsheet Freeware

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NOZLBORE.XLS
Nozzle Machining Aid

The most time consuming step of machining a rocket nozzle is the process of boring out the conical convergent and divergent passages. In particular, the divergent passage, which has a greater bore depth and more shallow angle. This step may be eased significantly by first drilling out these passages using a series of incrementally larger drill bits. The required drill bit sizes range from the throat diameter to the entrance (or exit) diameter of the nozzle. This operation results in a "stepped" profile which may then be bored to the final smooth profile with a standard boring bar tool. This spreadsheet is intended to aid this drilling operation by supplying the required drill depth for each drill bit size.
Written by Richard Nakka.

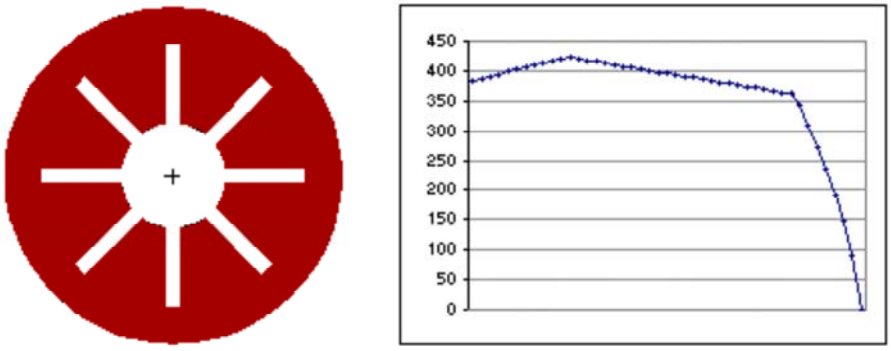
NOZLBORE.XLS Version 1.11 375kbytes EXCEL 2000 spreadsheet Freeware

Step-drilled divergent passage of A-100M nozzle.
A boring tool is then used to finish the contour.

PFC-BURN.XLS
Grain Geometric Analysis

This spreadsheet computes the Kn (burning-area to throat-area ratio) for a *Pseudo-finocyl* propellant grain. A Pseudo-finocyl grain configuration consists of a cylindrical grain with a circular bore, from which a number of fins extend radially (similar to a star-grain). Five independant geometric variables allow for great freedom in tailoring of the Kn profile. Such a grain may be fabricated by casting with a suitable mandrel, or by drilling the core, then cutting the fin slots.
Written by Richard Nakka.

PFC-BURN.XLS Version *Beta-1* 165kbytes EXCEL 2000 spreadsheet Freeware



Pseudo-finocyl grain cross-section. Example Kn chart.

Delaney/Nakka Ejection Charge Calculator

Simple to use Windows calculator that computes the mass of Black Powder needed to produce a specified pressure within a rocket parachute

compartment. The resulting force tending to eject the nosecone or to separate the rocket sections is also computed.
Software written by J.Delaney
Help written by Richard Nakka

EjectionChargeCalculator.zip Version *1.3* 1.4Mbytes MS Windows Freeware

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GRAINCHECK.XLS
Grain Density Check

This *Excel* spreadsheet computes the *actual mass density* of a sugar-propellant grain based on user input values of grain geometry and mass. This is compared to the *ideal mass density* by computing the ratio of the two densities. This provides the experimentalist with a "densitometric quality" assessment of a propellant grain. A good quality grain, one with minimal porosity and few voids or other flaws, will have a ratio close to one. A porous grain or a grain with hidden voids, for example, will be marked by a significantly lower density ratio. The usefulness of such a check is apparent when one considers that propellant burn rate and Kn profile can be strongly affected by such grain deficiencies. In extreme cases, a CATO could result from a grain with degraded densitometric quality.
Written by Richard Nakka.

GRAINDENSITY.XLS Version 1.00 40kbytes EXCEL 2000 spreadsheet Freeware

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O-RING.XLS
O-Ring Designer

The use of o-rings is an ideal means to pressure seal a rocket nozzle or bulkhead. O-rings are inexpensive, simple to incorporate, and are highly reliable. However, it is important to choose the correct size o-ring for a given application, and to have the correct size gland (groove) into which the o-ring is seated. This *Excel* spreadsheet selects the appropriate sized o-ring based on user input values of casing and nozzle diameters, based on *ARP 1232* specifications. Updated for 100, 200 & 300 series (3/32", 1/8" & 3/16") o-rings .
Written by Richard Nakka.

O-RING.XLS Version 2.2 872kbytes EXCEL spreadsheet Freeware

PDFCreator
Document converter

An extremely useful "open-source" (GNU GPL) software for reliably converting documents to *Acrobat* PDF format. Excellent for publishing articles for on-line format or for e-mailing. Can be used with any document software (examples: MS Word, MS Excel, PSP, QuickCAD, IE, Netscape). Easy to use -- instead of printing to a device, you simply print to *PDF Creator*.

PDFCreator Version 0.9.3

Last updated Aug.11, 2012

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