

E15-5

13X10

ROCKET MOTORS ARE LABELED WITH A SYSTEM INTENDED TO PROVIDE THE USER WITH ENOUGH INFORMATION TO DETERMINE THE SUITABILITY OF A MOTOR FOR ANY PARTICULAR USE.

E15-5

13X10

MOTOR IMPULSE CLASS

AVERAGE THRUST IN NEWTONS

THE FIRST LETTER INDICATES THE TOTAL IMPULSE CLASSIFICATION OF THE MOTOR, AND THE NUMBERS IMMEDIATELY FOLLOWING THAT LETTER REPORT THE AVERAGE THRUST OF THE MOTOR IN NEWTONS. THE TERMS "TOTAL IMPULSE" AND "AVERAGE THRUST" ARE EXPLAINED IN THE FOLLOWING SCREENS.

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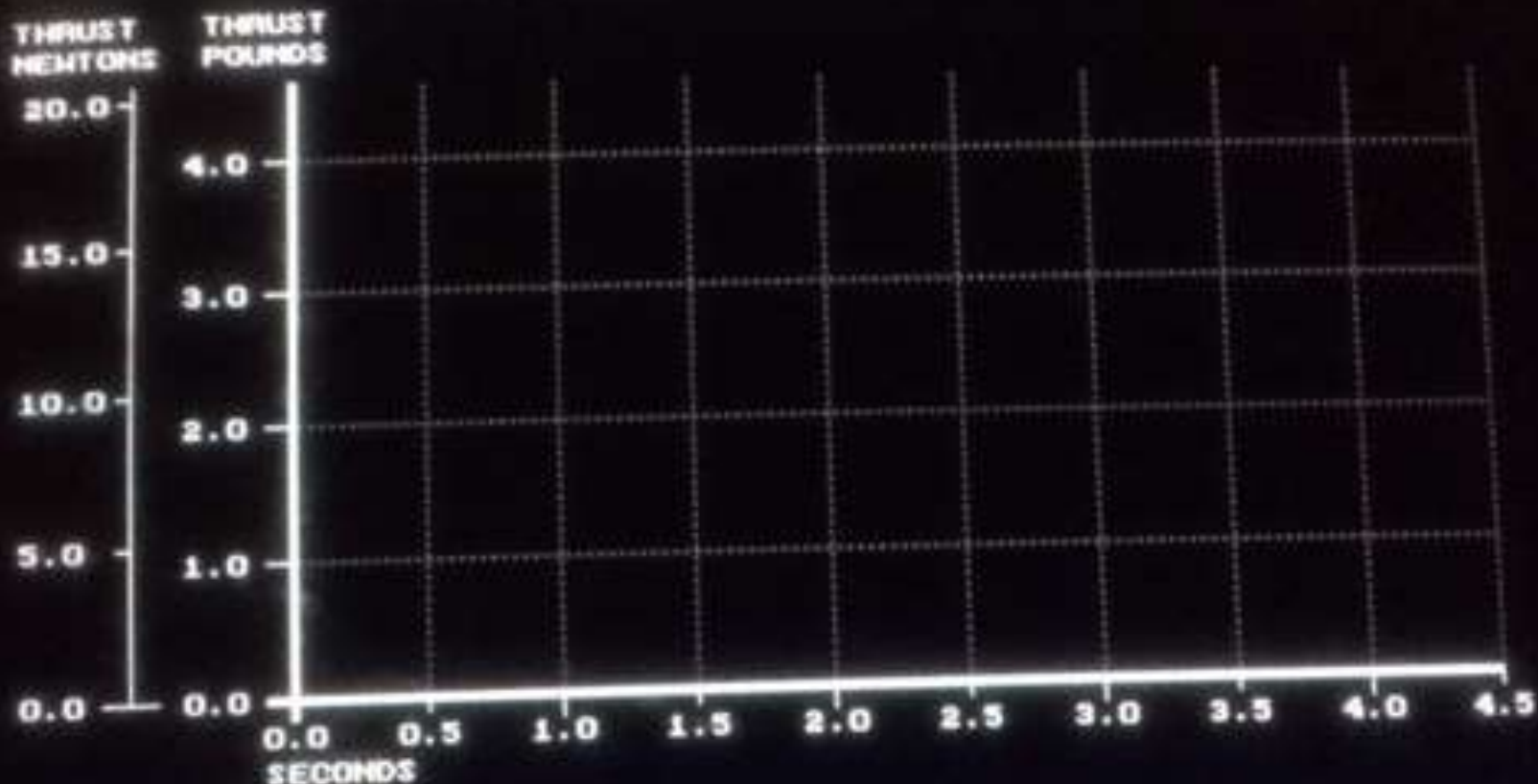
MOTOR IMPULSE CLASS

AVERAGE THRUST IN NEWTONS

TO UNDERSTAND "TOTAL IMPULSE" AND "AVERAGE THRUST" IT IS NECESSARY TO LOOK AT A GRAPH OF THE THRUST GENERATED BY THE MOTOR DURING ITS BURN TIME. THIS GRAPH IS CALLED THE "THRUST-TIME CHARACTERISTIC" OF THE MOTOR.

MOTORTUT: ROCKET MOTOR TUTORIAL
ROCKET MOTOR CLASSES AND THRUST-TIME CURVES

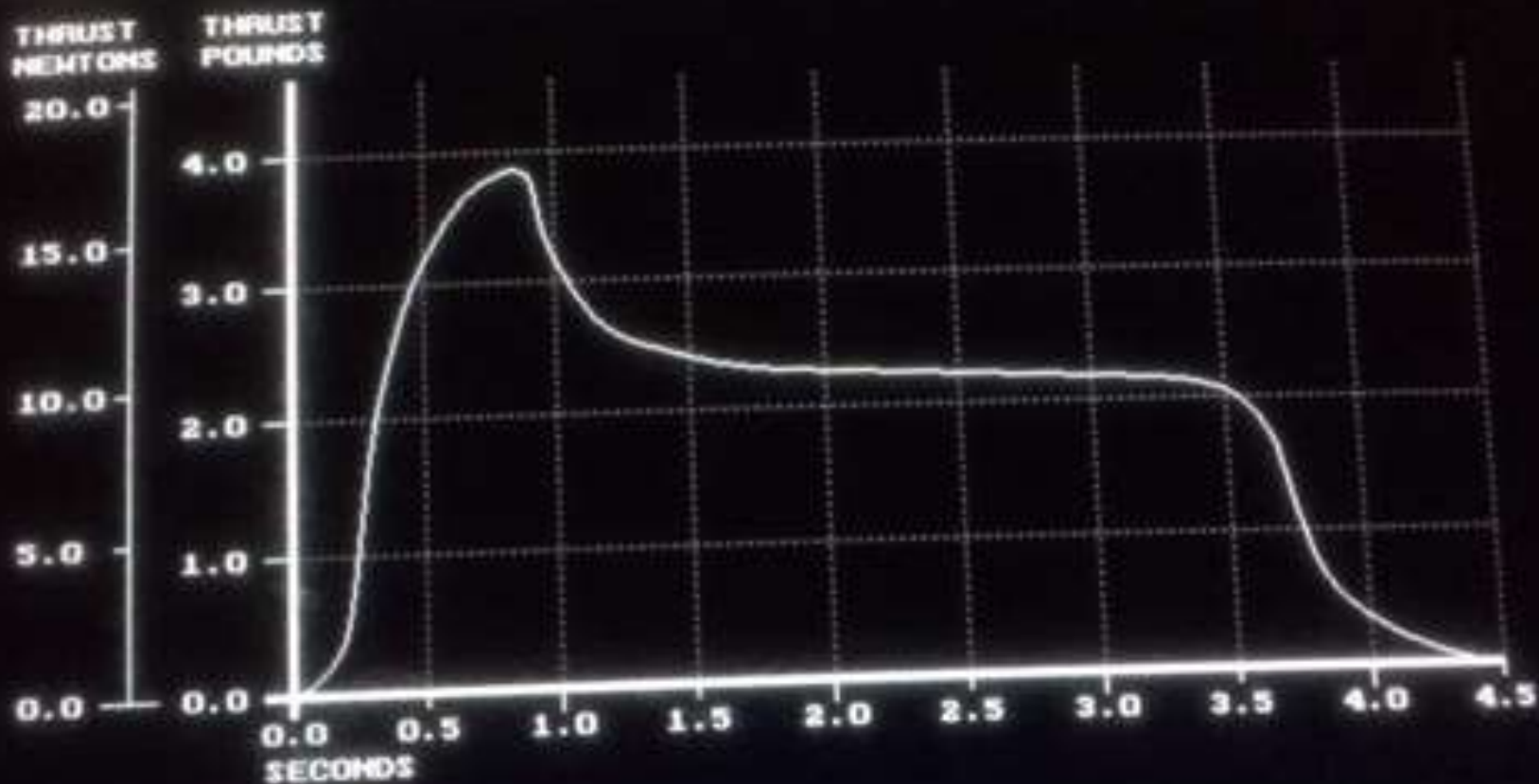
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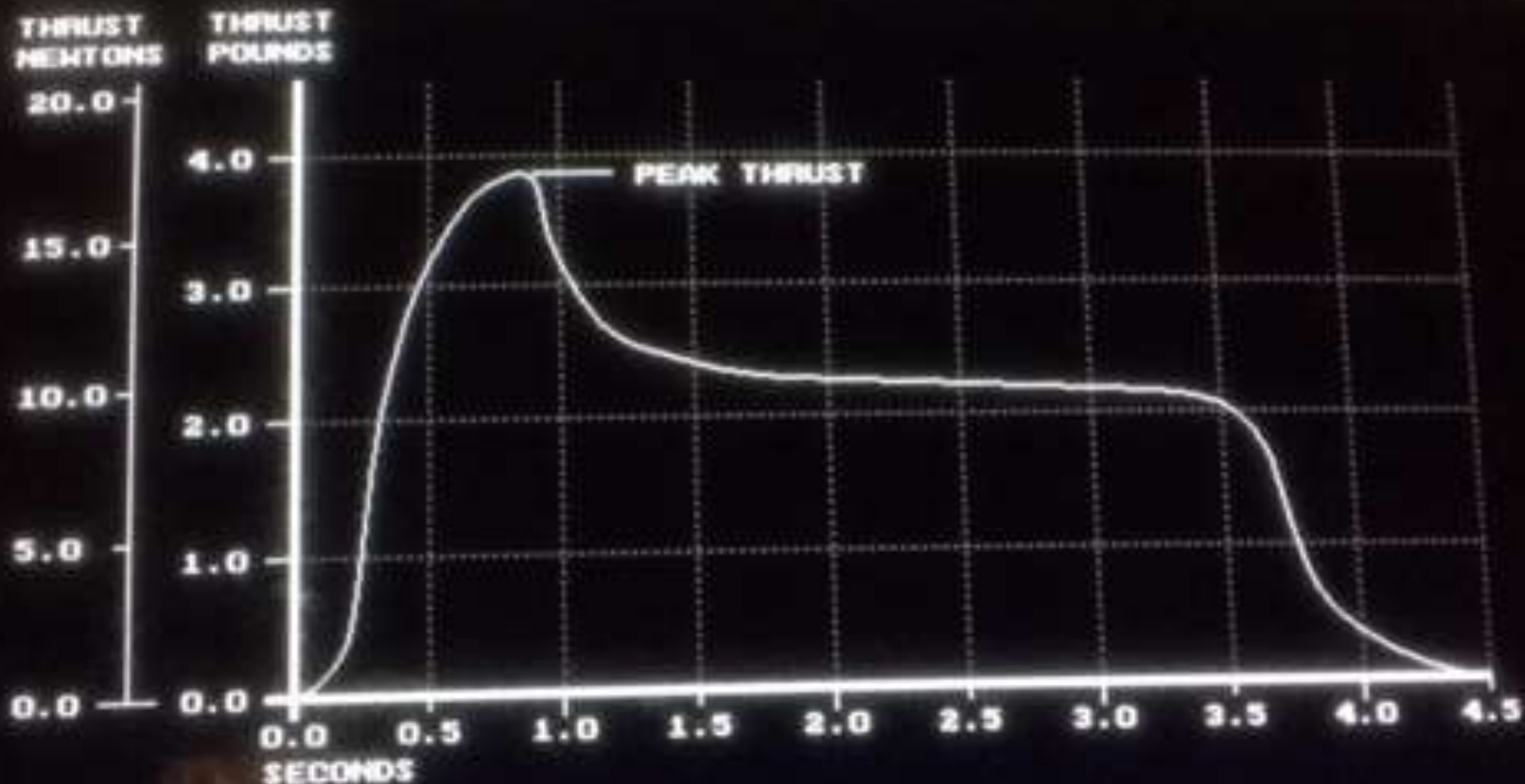
A THRUST-TIME CURVE IS A GRAPHICAL REPRESENTATION OF THE THRUST VS. TIME PERFORMANCE OF A ROCKET MOTOR. TIME IS MEASURED ALONG THE HORIZONTAL AXIS IN SECONDS; THE THRUST IS MEASURED ALONG THE VERTICAL AXIS IN UNITS OF POUNDS OR NEWTONS. (NEWTONS ARE UNITS OF FORCE IN THE METRIC SYSTEM: 1 Lb = 4.45 Nt.)

MOTORTUT: ROCKET MOTOR TUTORIAL
ROCKET MOTOR CLASSES AND THRUST-TIME CURVES

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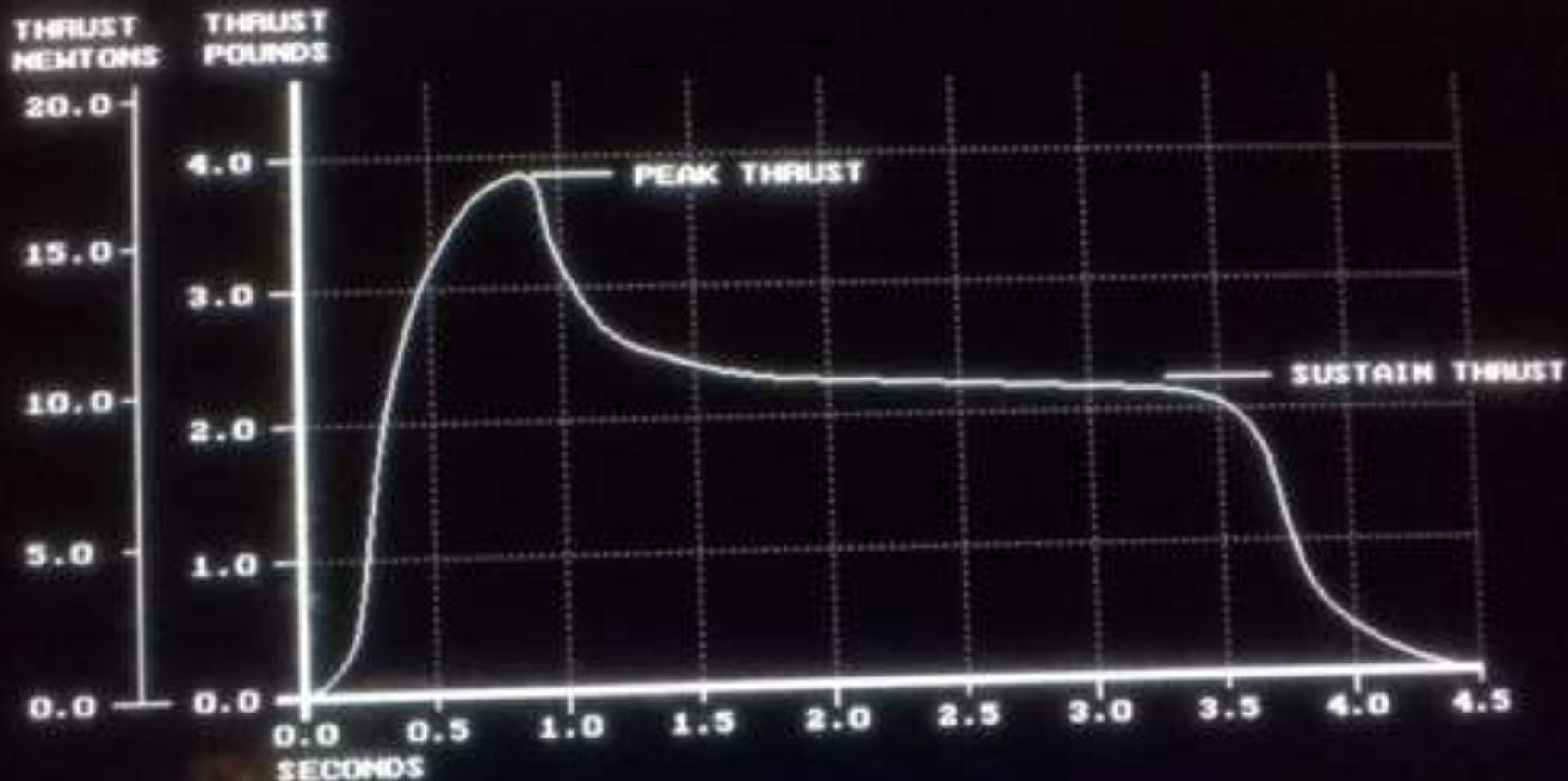
DIFFERENT MOTORS HAVE DIFFERENT THRUST-TIME CURVE SHAPES. THIS IS THE TYPICAL SHAPE OF OF A PARTIALLY CORED BLACK POWDER MOTOR. OTHER THRUST-TIME CURVE SHAPES WILL BE PRESENTED WITH THEIR RESPECTIVE MOTOR ANIMATIONS.



THE PEAK THRUST OF THE MOTOR IS THE HIGHEST POINT ON THE THRUST-TIME CURVE. THE PEAK OF THIS MOTOR IS ABOUT 3.9 Lbs. (17.4 Nt.)

MOTORTUT: ROCKET MOTOR TUTORIAL
ROCKET MOTOR CLASSES AND THRUST-TIME CURVES

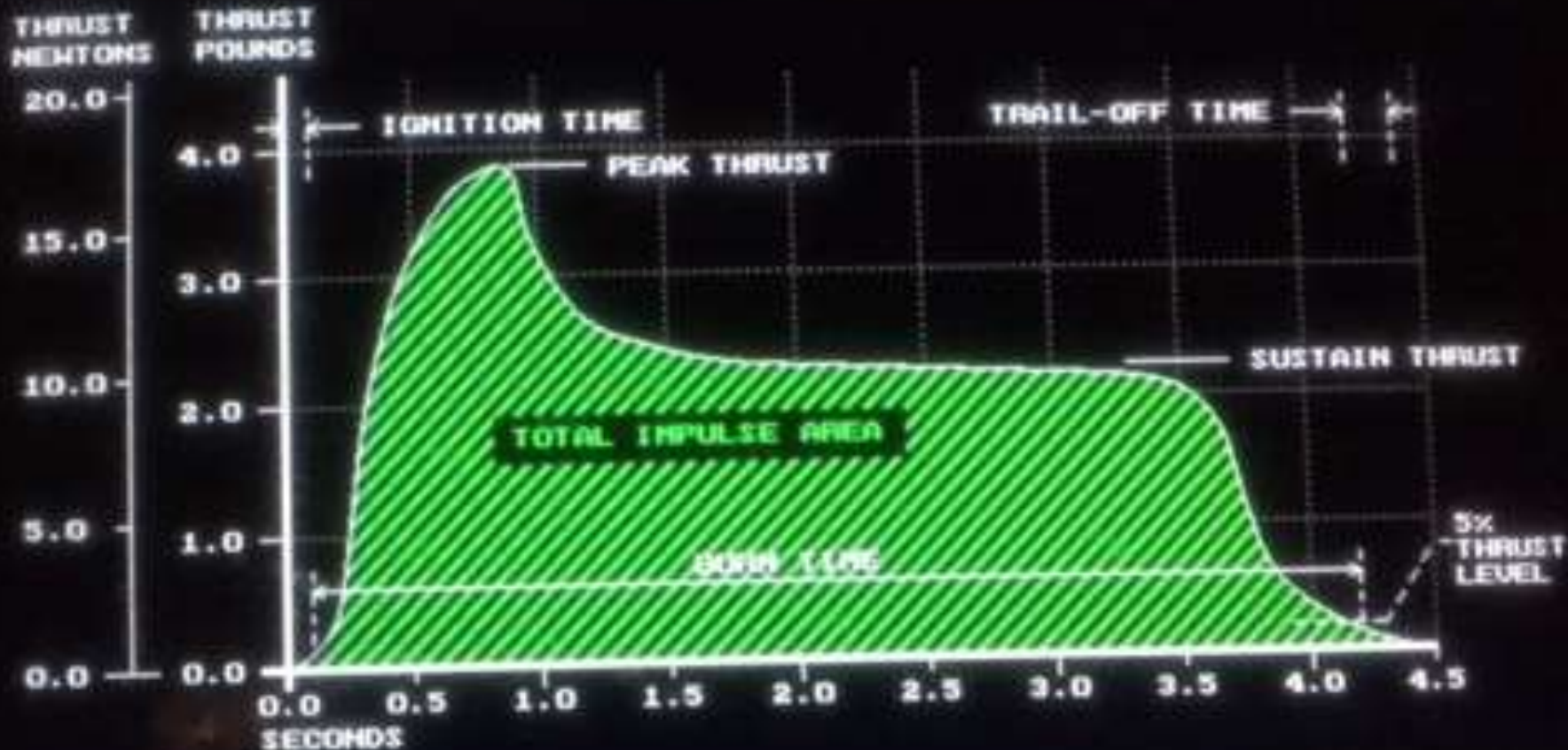
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THE PEAK THRUST OF THE MOTOR IS THE HIGHEST POINT ON THE THRUST-TIME CURVE. THE PEAK OF THIS MOTOR IS ABOUT 3.9 Lbs. (17.4 Nt.)
THE SUSTAINING THRUST IS THE NEARLY CONSTANT THRUST PORTION OF THE CURVE THAT EXTENDS FOR THE LARGEST PORTION OF THE BURN TIME.



BURN TIME OF A MOTOR IS TYPICALLY MEASURED FROM THE POINT AT WHICH THE THRUST RISES TO 5% OF ITS PEAK VALUE, TO WHERE IT DECLINES TO 5% OF ITS PEAK VALUE. THIS METHOD PREVENTS BURN TIMES FROM BEING DISTORTED BY SLOW IGNITION OR EXCESSIVE THRUST TRAIL-OFF TIME. THE BURN TIME OF THIS MOTOR IS ABOUT 4.1 SEC.

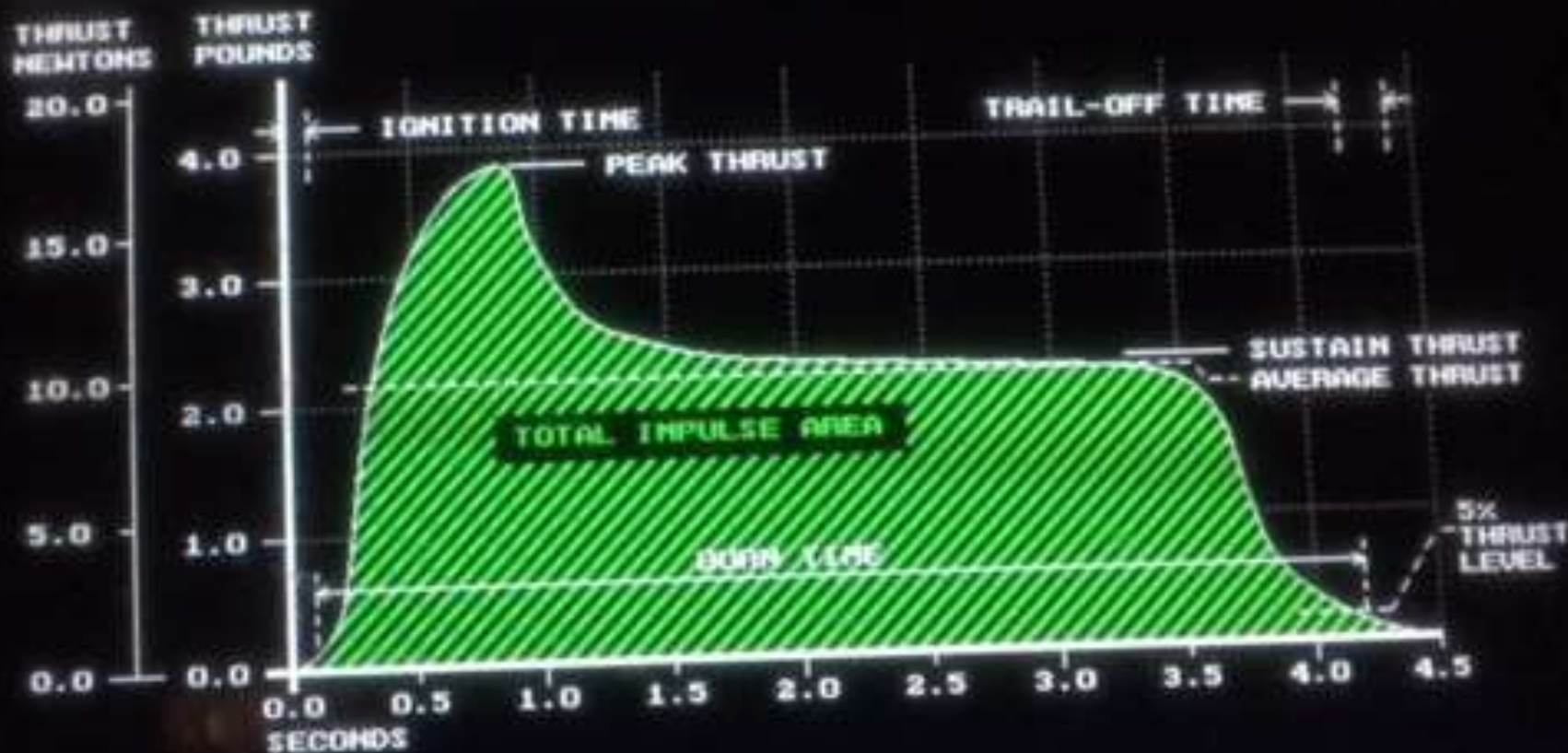


THE TOTAL IMPULSE OF A MOTOR IS THE TOTAL AREA UNDER THE THRUST-TIME CURVE. SINCE THE AXES ARE IN UNITS OF FORCE AND TIME, TOTAL IMPULSE IS MEASURED IN UNITS OF LB-SEC (ENGLISH), OR NEWTON-SEC (METRIC). TOTAL IMPULSE IS A MEASURE OF THE TOTAL ENERGY CONTAINED IN THE MOTOR. THE TOTAL IMPULSE OF THIS MOTOR IS ABOUT 9.8 LB-SEC, OR 44 NT-SEC.

MOTORTUT: ROCKET MOTOR TUTORIAL

ROCKET MOTOR CLASSES AND THRUST-TIME CURVES

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THE AVERAGE THRUST OF A MOTOR IS ITS TOTAL IMPULSE DIVIDED BY ITS BURN TIME. THE AVERAGE THRUST IS AN INDICATION OF HOW QUICKLY A MOTOR WILL ACCELERATE A ROCKET. (CAUTION: THE PEAK AND SUSTAIN THRUST SHOULD ALSO BE CONSIDERED WHEN DETERMINING THE SUITABILITY OF A PARTICULAR MOTOR.) THE AVERAGE THRUST OF THIS MOTOR IS ABOUT 2.1 Lb., OR 9.3 Nt.

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MOTOR IMPULSE CLASS

AVERAGE THRUST IN NEWTONS

THE AVERAGE THRUST IS INDICATED BY THE NUMBERS FOLLOWING THE TOTAL IMPULSE CLASSIFICATION. THE LETTER CODE INDICATING THE TOTAL IMPULSE CLASS IS EXPLAINED IN THE NEXT SCREEN. REMEMBER THAT THE "TOTAL IMPULSE" IS A MEASURE OF THE TOTAL POWER OF A MOTOR.

MOTORTUT: ROCKET MOTOR TUTORIAL
ROCKET MOTOR CLASSES AND THRUST-TIME CURVES

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LETTER DESIGNATIONS ARE USED TO INDICATE THE TOTAL IMPULSE CLASSIFICATION OF A MOTOR. AN "A" MOTOR CAN CONTAIN UP TO 2.5 Nt-Sec OF TOTAL IMPULSE, REPRESENTED HERE BY THE SIZE OF THE BLUE SQUARE.

1/2A AND 1/4A DESIGNATIONS INDICATE FRACTIONAL SIZES OF A FULL "A".

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ROCKET MOTOR CLASSES AND THRUST-TIME CURVES

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A "B" SIZE MOTOR CAN CONTAIN UP TO 5.0 Nt-Sec OF TOTAL IMPULSE, TWICE AS MUCH AS AN "A" MOTOR.

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A "C" SIZE MOTOR CAN CONTAIN UP TO 10 Nt-sec OF TOTAL IMPULSE, TWICE AS MUCH AS A "B" MOTOR.

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THE DOUBLING OF TOTAL IMPULSE CONTINUES FOR EACH LETTER CLASS.

THE MAXIMUM FOR "D" CLASS MOTORS IS 20 NEWTON-SECONDS.

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THE DOUBLING OF TOTAL IMPULSE CONTINUES FOR EACH LETTER CLASS.
THE MAXIMUM FOR "E" CLASS MOTORS IS 40 NEWTON-SECONDS.

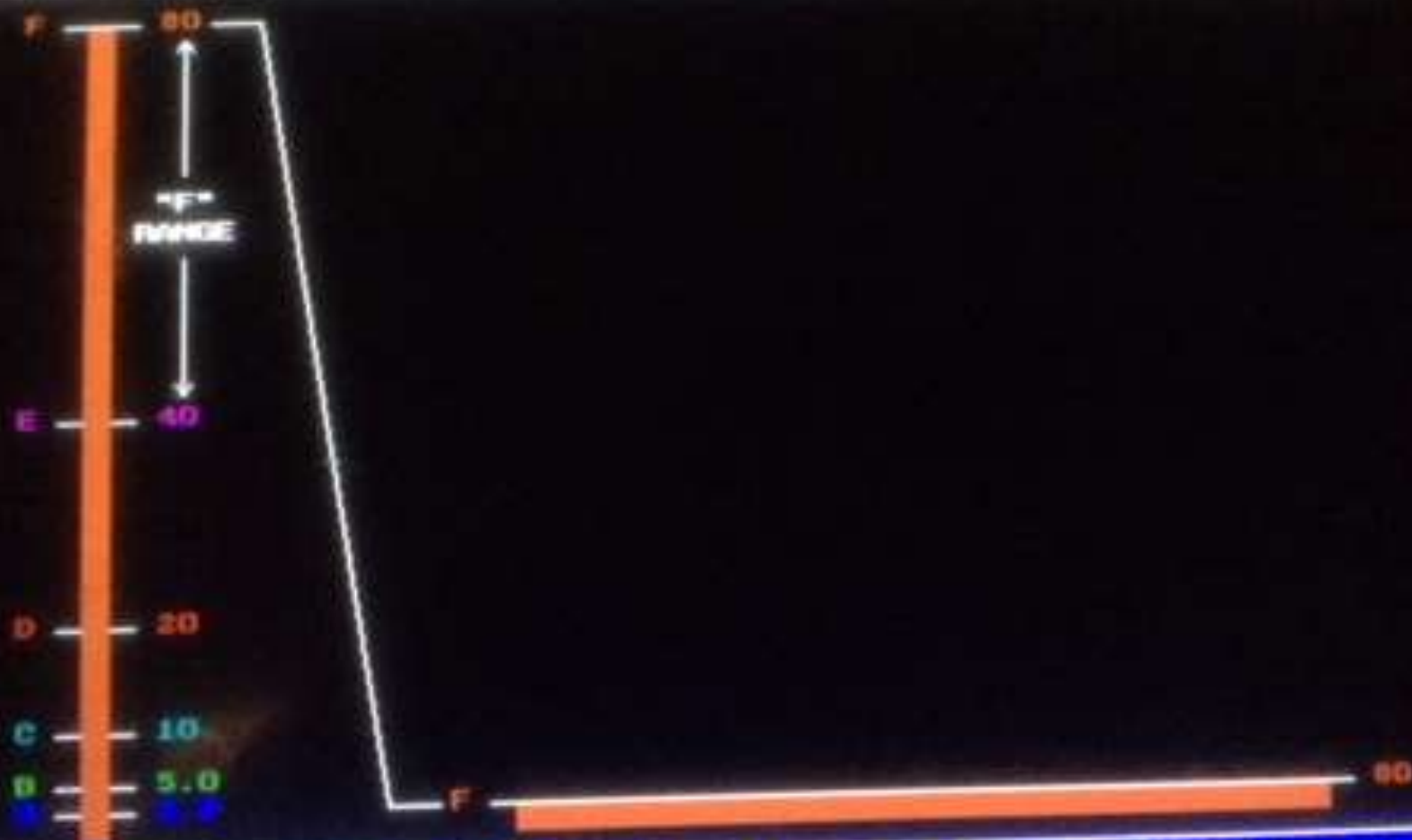


THE DOUBLING OF TOTAL IMPULSE CONTINUES FOR EACH LETTER CLASS.

THE TOTAL IMPULSE OF ANY PARTICULAR MOTOR IS NOT NECESSARILY THE MAXIMUM POSSIBLE FOR ITS CLASS. FOR EXAMPLE, A MOTOR CLASSIFIED AS AN "F" COULD HAVE A TOTAL IMPULSE IN THE RANGE BETWEEN 40 AND 80 NEWTON-SECONDS.

MOTOR TUTOR: ROCKET MOTOR TUTORIAL
ROCKET MOTOR CLASSES AND THRUST-TIME CURVES

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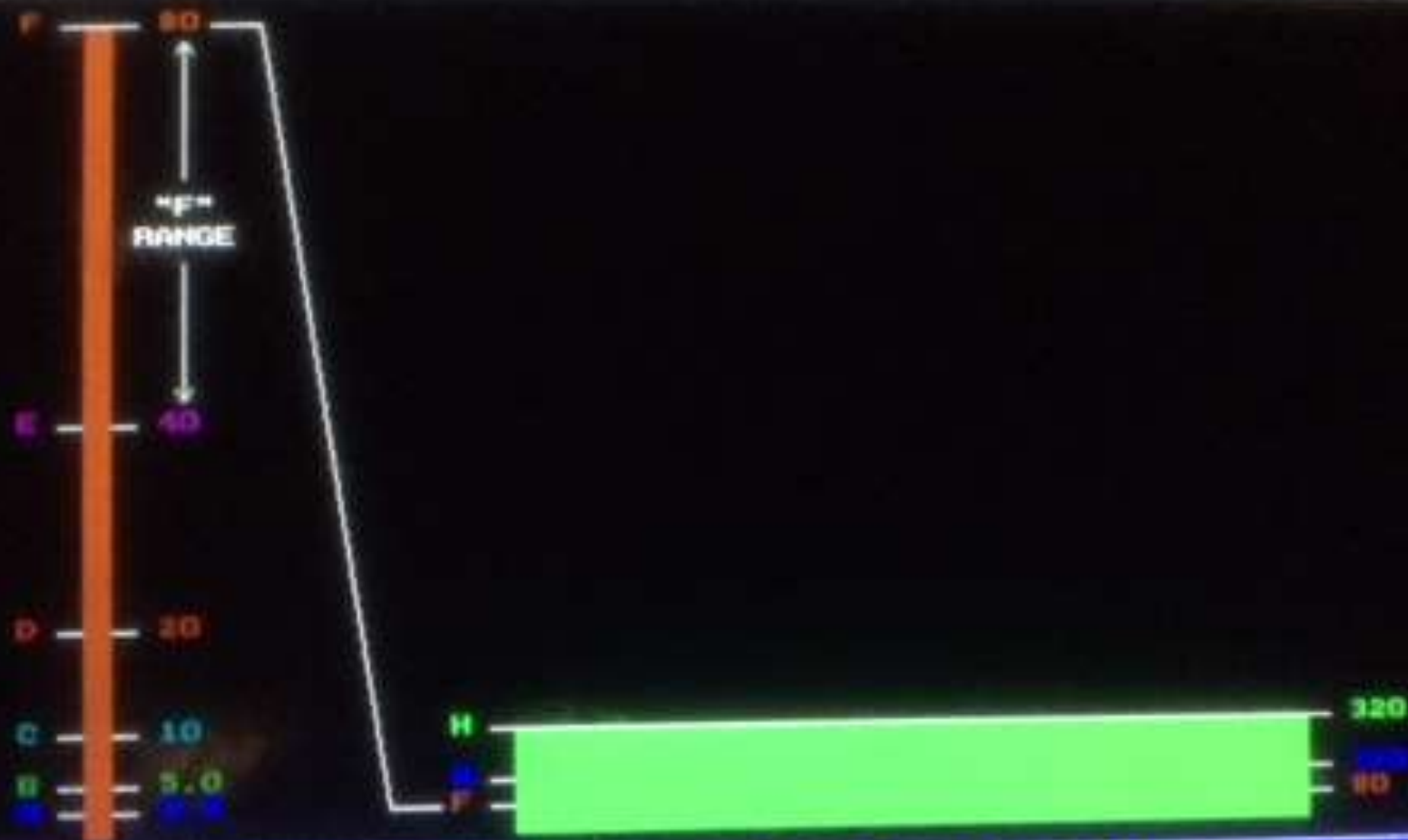
IN EARLY MODEL ROCKETRY, THE "F" MOTOR WAS THE LARGEST THAT WAS USUALLY COMMERCIALY AVAILABLE. CURRENTLY HOWEVER, THERE ARE A NUMBER OF MANUFACTURERS PRODUCING MOTORS IN HIGHER IMPULSE CLASSES.

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ROCKET MOTOR CLASSES AND THRUST-TIME CURVES

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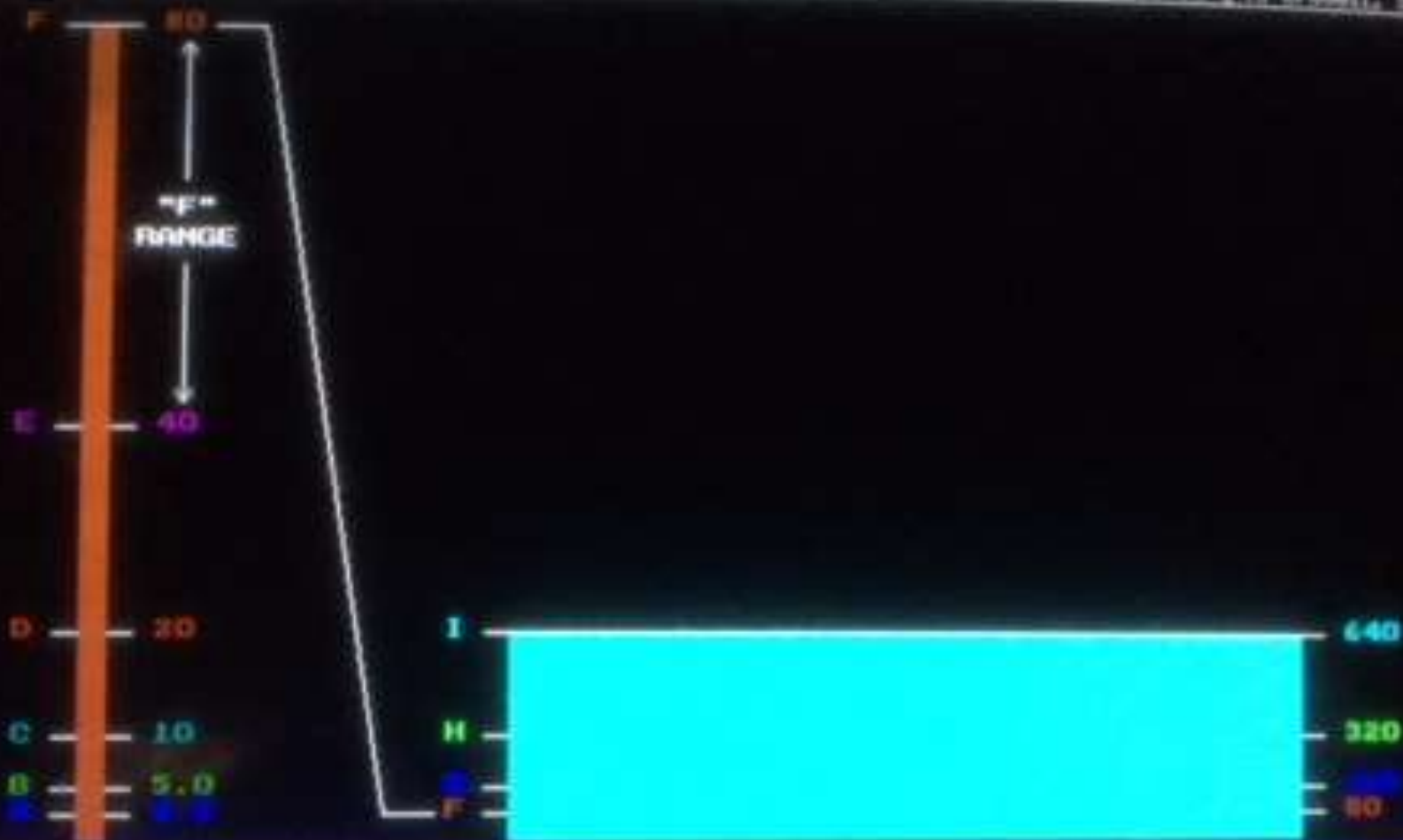
THE DOUBLING OF TOTAL IMPULSE CONTINUES FOR EACH LETTER CLASS. THE MAXIMUM FOR "G" CLASS MOTORS IS 160 NEWTON-SECONDS. MODEL ROCKET MOTORS, WHICH ARE CLASSIFIED AS "CLASS C TOY PROPELLANT DEVICES," MUST CONTAIN LESS THAN 62.5 GRAMS OF PROPELLANT. THIS LIMITS THE LARGEST MODEL ROCKET MOTORS TO THE "G" CLASS.



THE DOUBLING OF TOTAL IMPULSE CONTINUES FOR EACH LETTER CLASS. THE MAXIMUM FOR "H" CLASS MOTORS IS 320 NEWTON-SECONDS. ROCKET MOTORS WITH MORE THAN 62.5 GRAMS OF PROPELLANT ARE REGULATED AS "CLASS B EXPLOSIVES," AND THEIR PURCHASE AND USE REQUIRE USER CERTIFICATION BY THE NATIONAL ASSOCIATION OF ROCKETRY OR THE TRIPOLI ROCKETRY ASSOCIATION.

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THE DOUBLING OF TOTAL IMPULSE CONTINUES FOR EACH LETTER CLASS.

THE MAXIMUM FOR "I" CLASS MOTORS IS 640 NEWTON-SECONDS.

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ROCKET MOTOR CLASSES AND THRUST-TIME CURVES

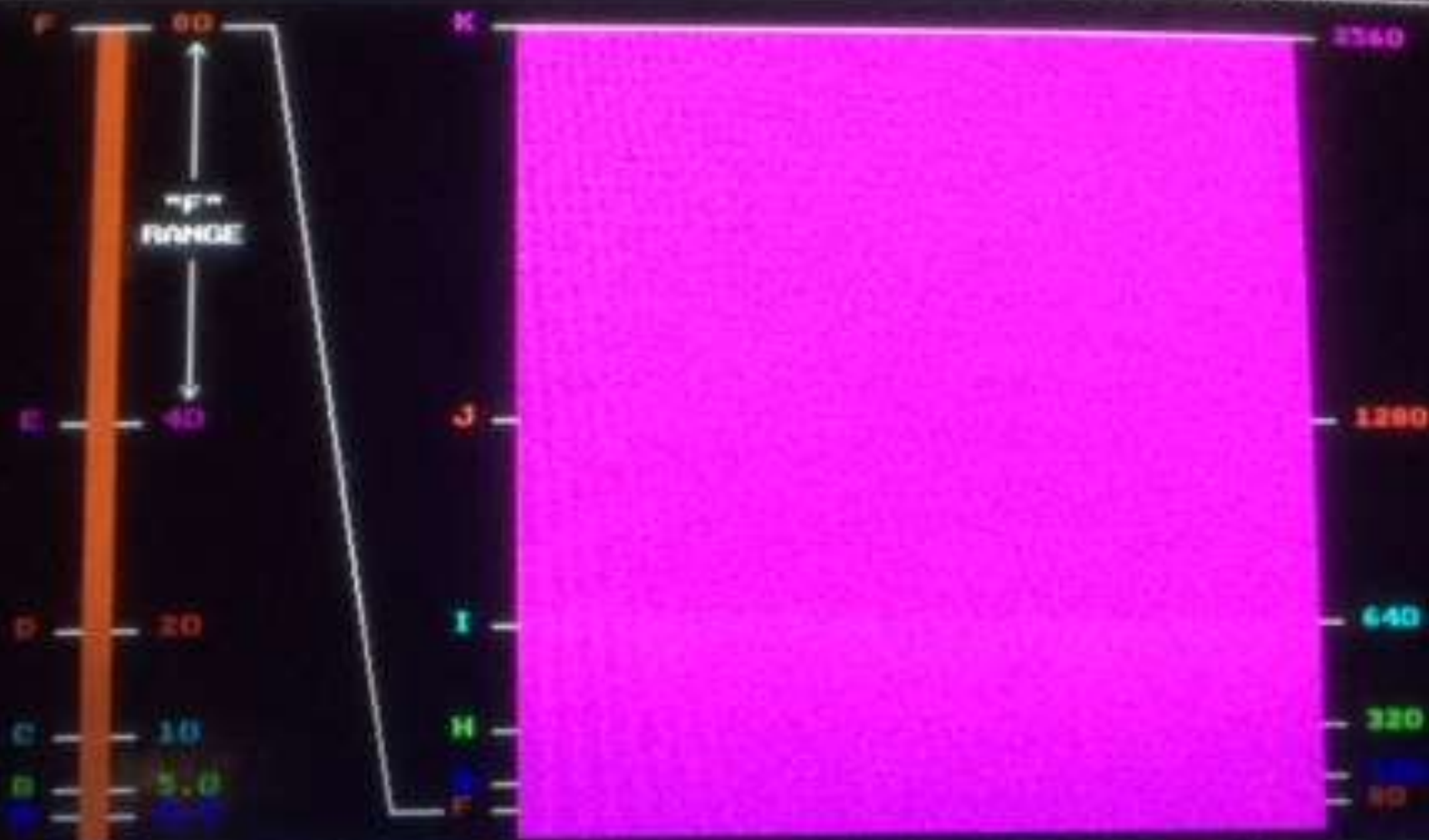
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THE DOUBLING OF TOTAL IMPULSE CONTINUES FOR EACH LETTER CLASS.
THE MAXIMUM FOR "J" CLASS MOTORS IS 1280 NEWTON-SECONDS.

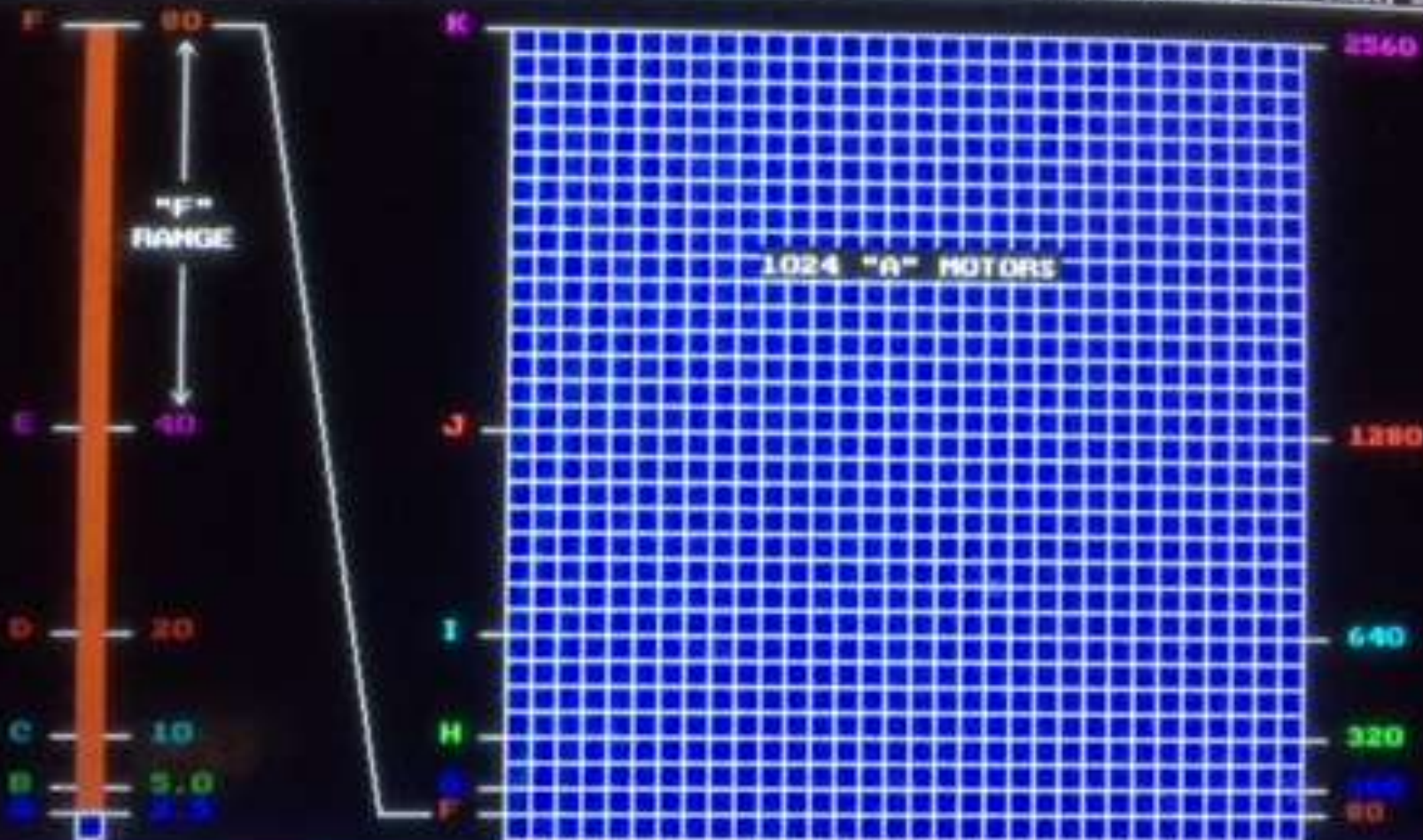
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THE DOUBLING OF TOTAL IMPULSE CONTINUES FOR EACH LETTER CLASS.

THE MAXIMUM FOR "K" CLASS MOTORS IS 160 NEWTON-SECONDS.



REMEMBER THE 2.5 Nt-Sec "A" MOTOR?

IT TAKES OVER ONE THOUSAND "A" MOTORS TO EQUAL ONE "K" MOTOR.
 NOTE THAT THE DOUBLING CONTINUES WITH STILL LARGER MOTORS. L, M, N, AND O-SIZE MOTORS HAVE BEEN CONSTRUCTED. AN "O" IS 16 TIMES LARGER THAN A "K".

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MOTOR IMPULSE CLASS

EJECTION CHARGE DELAY

AVERAGE THRUST IN NEWTONS

THE NUMBER FOLLOWING THE DASH IS THE DELAY TIME MEASURED IN SECONDS. THE DELAY TIME BEGINS AFTER THE BURNOUT OF THE THRUST PORTION OF THE MOTOR'S OPERATION. AT THE END OF THE DELAY TIME, A SMALL CHARGE BLOWS FORWARD FROM THE MOTOR TO EJECT THE RECOVERY SYSTEM.



MOTOR IMPULSE CLASS

13X10

EJECTION CHARGE DELAY
-0 = BOOSTER MOTOR

AVERAGE THRUST IN NEWTONS

A "-0" DELAY TIME INDICATES A BOOSTER MOTOR. THE PROPELLANT SURFACE OF A BOOSTER MOTOR IS EXPOSED AT THE TOP SO THAT IT WILL IGNITE AN UPPER STAGE MOTOR WHEN IT BURNS THROUGH.

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MOTOR IMPULSE CLASS

EJECTION CHARGE DELAY

-0 = BOOSTER MOTOR

P = PLUGGED

AVERAGE THRUST IN NEWTONS

A LETTER "P" APPEARING IN THE DELAY TIME POSITION INDICATES THE MOTOR IS "PLUGGED." THE EJECTION END OF THE MOTOR IS SEALED TO PREVENT ANY BURNING MATERIAL FROM BLOWING FORWARD. PLUGGED MOTORS ARE USUALLY USED IN ROCKET POWERED GLIDERS OR ROCKETS THAT USE SOME ALTERNATE MEANS OF ACTUATING A RECOVERY SYSTEM.



MOTORS USUALLY HAVE A "DATE CODE" THAT CAN BE USED TO DETERMINE THE DATE OF MANUFACTURE OF THE MOTOR. THIS CODE CAN BE USED TO IDENTIFY PRODUCTION BATCHES OF MOTORS, SO THAT MANUFACTURING PROBLEMS ASSOCIATED WITH PARTICULAR BATCHES CAN BE TRACKED. DETERMINING THE ACTUAL DATE FROM THE CODE REQUIRES USE OF A SECRET DECODER RING.