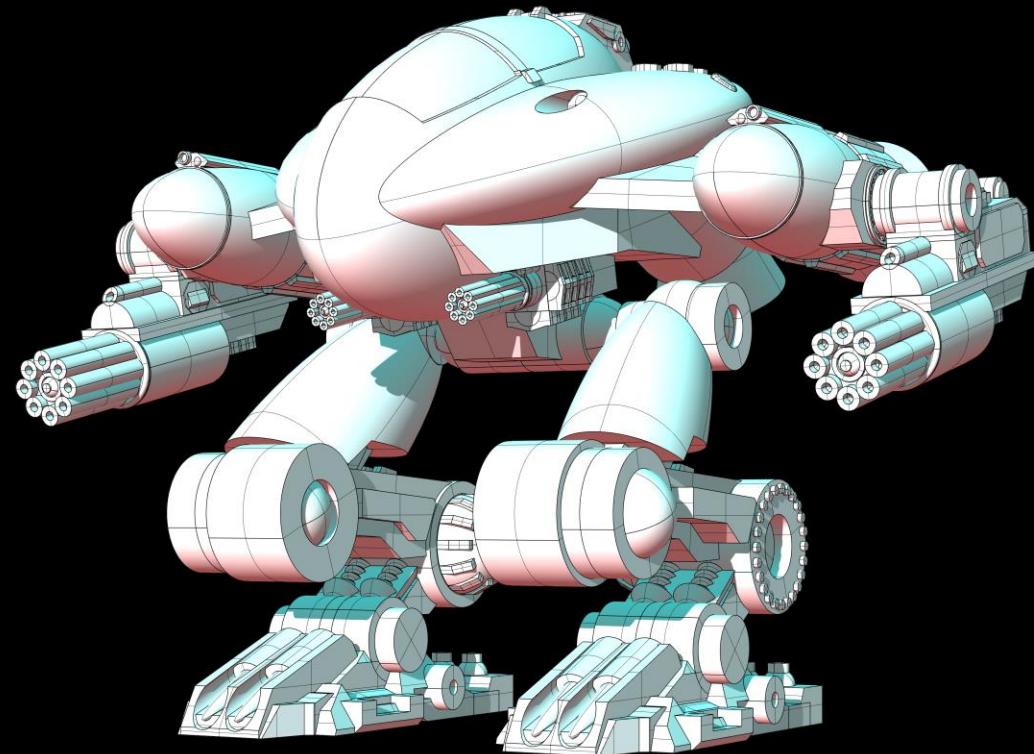


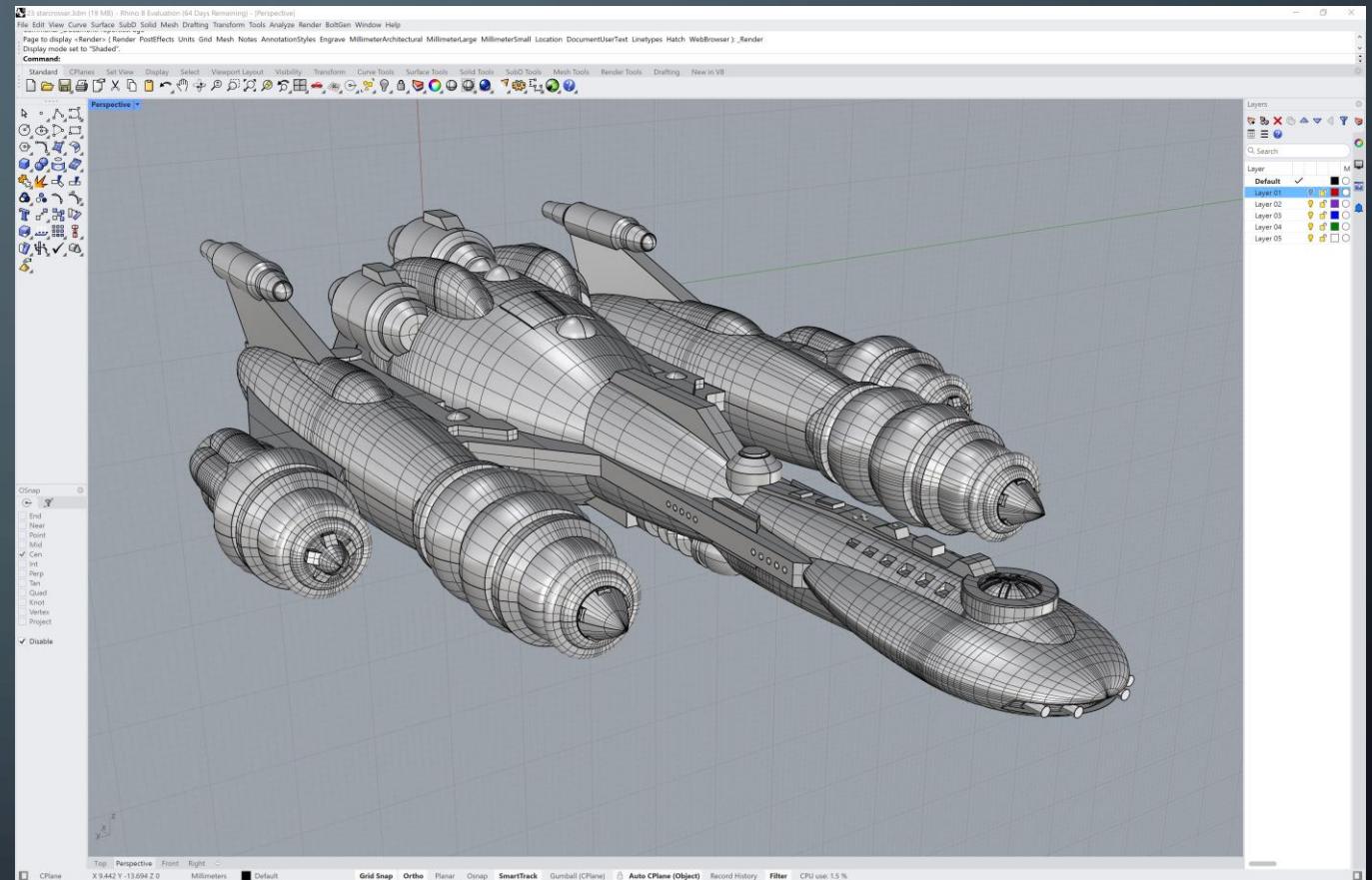
# CAD CONCEPTS AND RHINO3D: TURNING YOUR IDEA INTO A "THING"

BY BRIAN CARNES 2024.1 EDITION



# WHY WE ARE HERE?

THE GOAL OF THIS SESSION IS  
TO LEARN THE BASICS OF HOW  
TO BUILD MODELS IN CAD THEN  
LEARN TO APPLY THEM IN  
RHINOCEROS (RHINO3D) – A  
PROFESSIONAL CAD TOOL



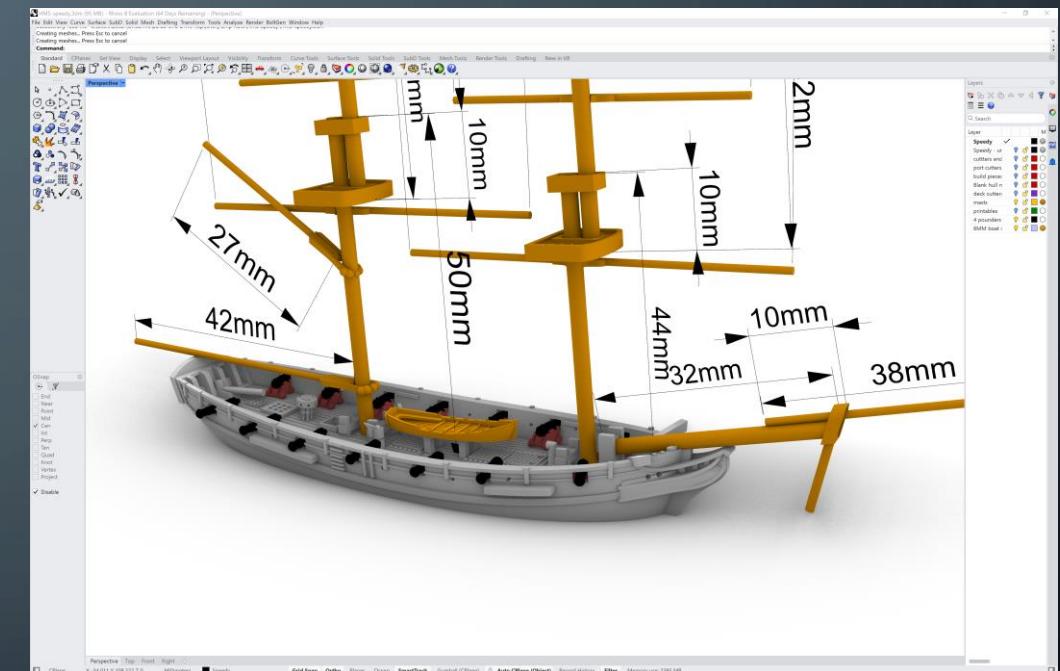
# WHAT WE'LL NEED

THE TOOL WE WILL USE TODAY IS RHINO3D ...

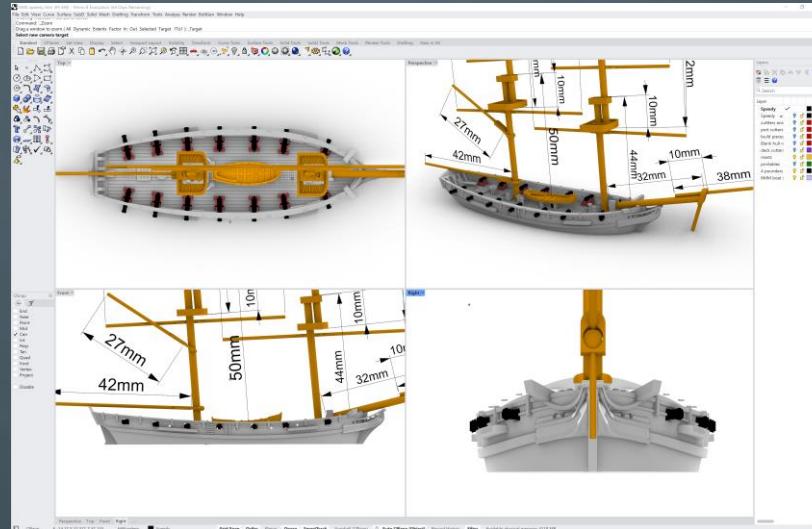
[HTTPS://WWW.RHINO3D.COM/DOWNLOAD](https://www.rhino3d.com/download)

THERE IS A MAC VERSION OF RHINO AVAILABLE,  
THERE ARE MINOR INTERFACE DIFFERENCES ON  
THIS VERSION

YOU WILL ALSO NEED A MOUSE, PREFERABLY  
WITH A SCROLL WHEEL



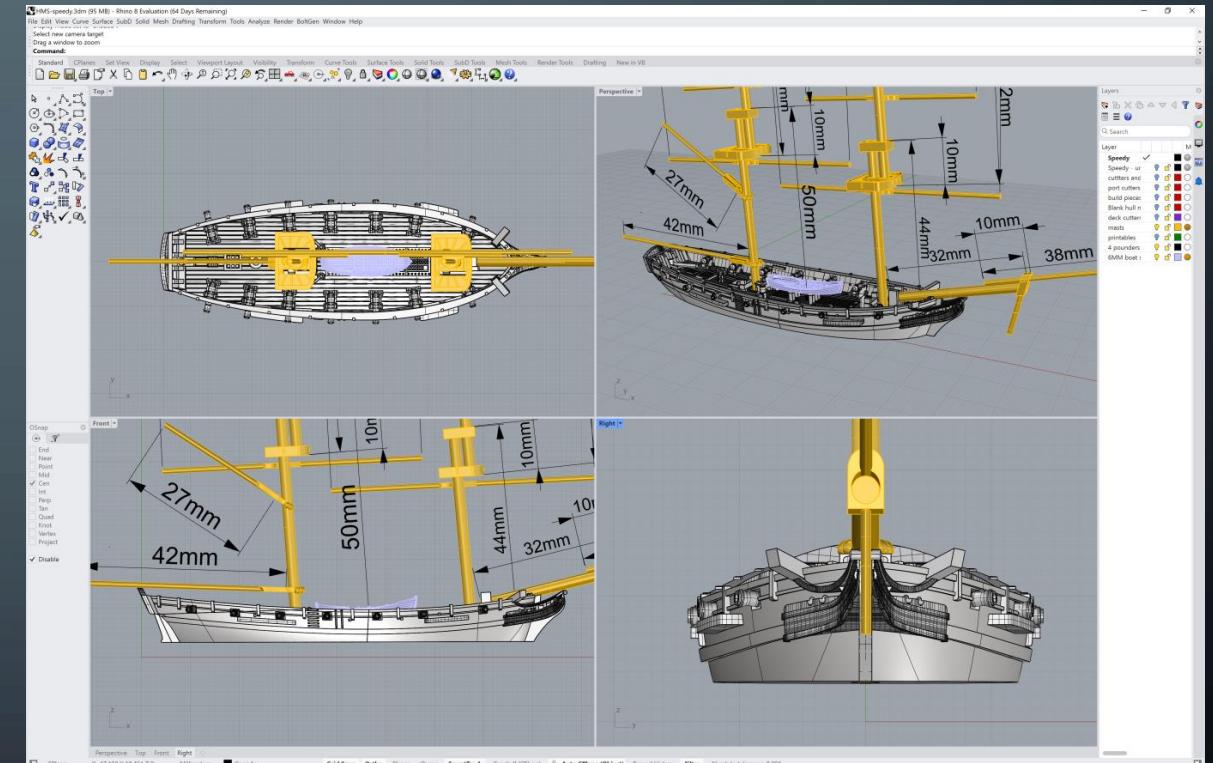
# CAD = COMPUTER AIDED DESIGN



THERE ARE MANY TYPES OF CAD PROGRAMS AVAILABLE AT ALL DIFFERENT COMPLEXITY LEVELS AND PRICES ... WHILE THEY ALL OPERATE DIFFERENTLY, THEY TEND TO FOLLOW SIMILAR CONCEPTS. THE ONLY EXCEPTION ARE THE ORGANIC SCULPTING TOOLS WHICH OPERATE MORE LIKE DIGITAL VERSIONS OF CLAY BALL MODELING

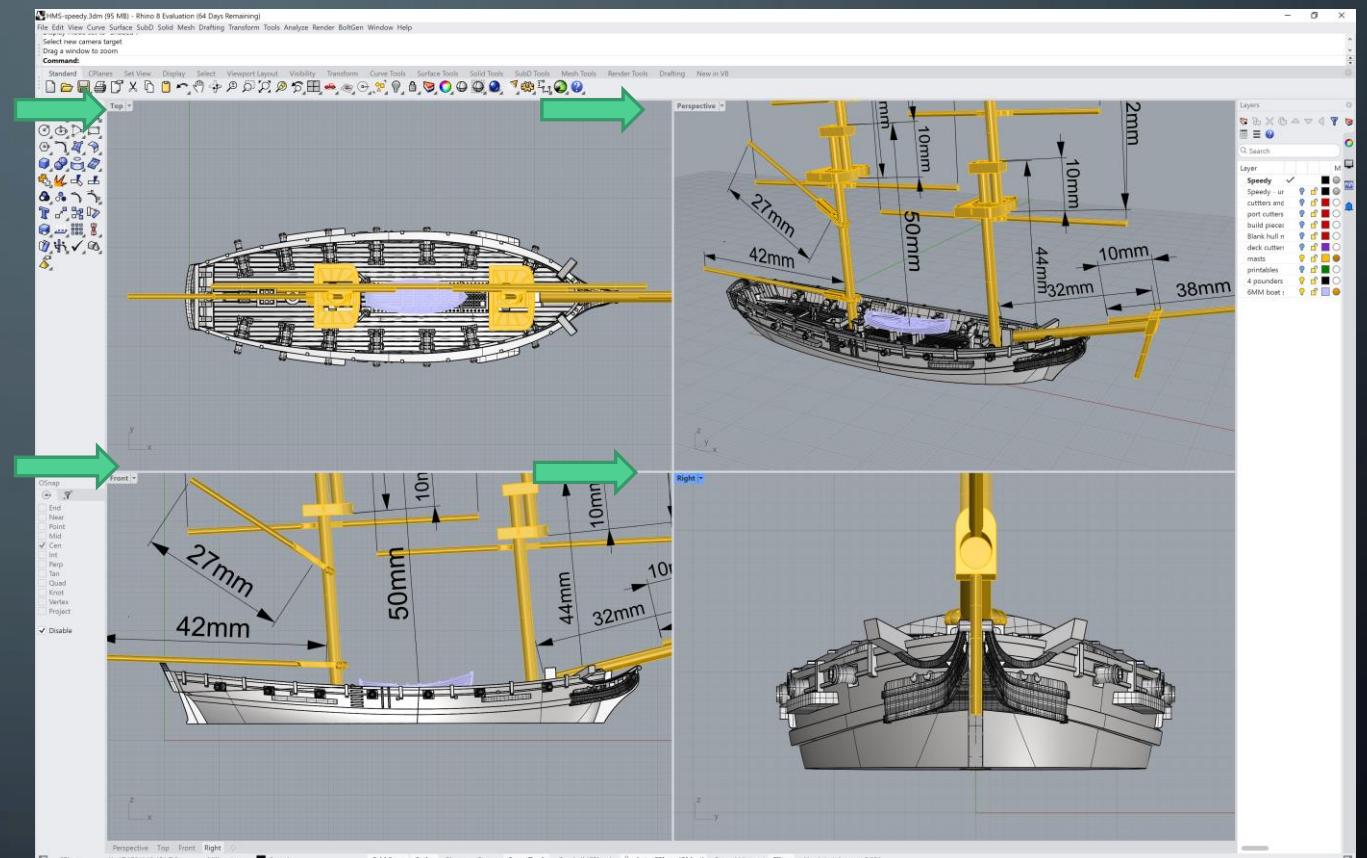
# RHINO OVERVIEW

THIS IS RHINO THE PROGRAM WE  
WILL USE TODAY



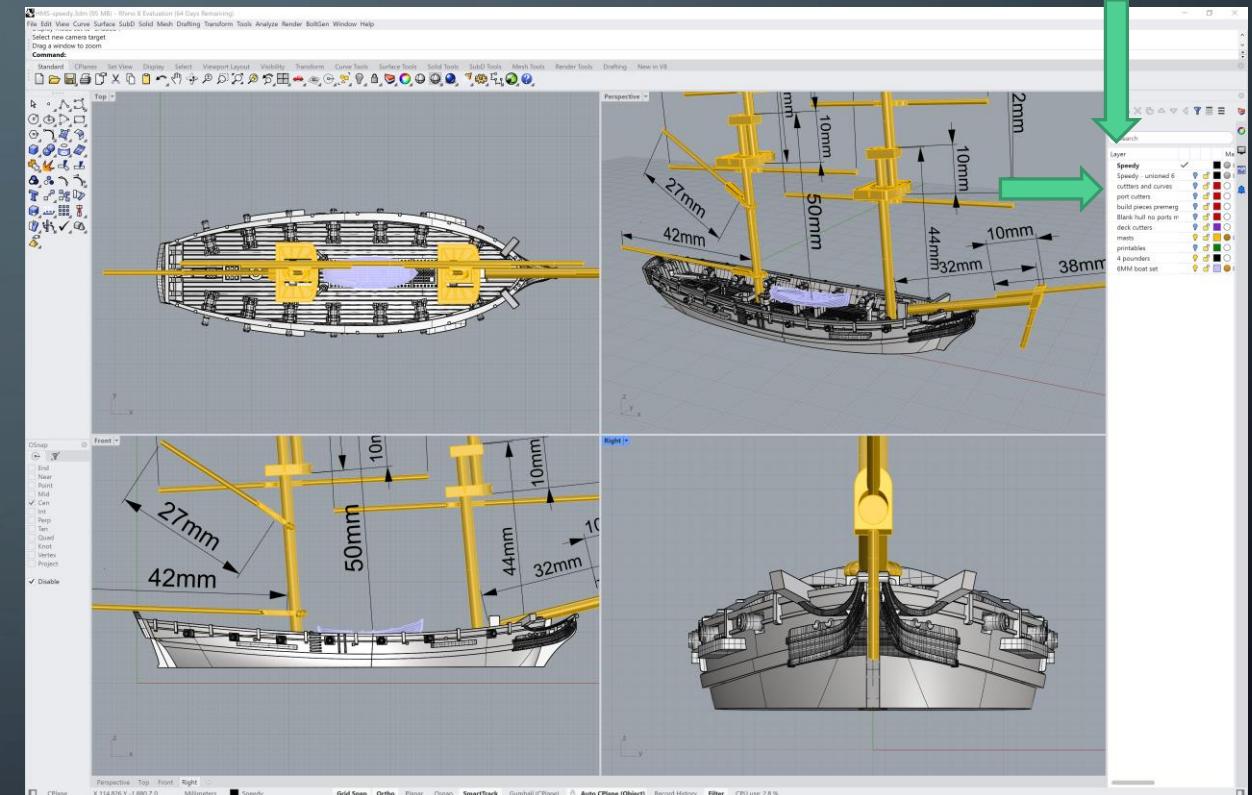
# RHINO OVERVIEW - BASICS

RHINO USES 4 VIEWPORTS BY DEFAULT ALTHOUGH YOU CAN ADD REMOVE OR REDEFINE VIEWPORTS AS NEEDED



# RHINO OVERVIEW - BASICS

TO THE RIGHT YOU WILL NOTICE THAT RHINO USES LAYERS LIKE A PAINT PROGRAM. THIS ALLOWS YOU TO ORGANIZE PARTS OF YOUR MODEL, MULTIPLE VERSIONS, OR EVEN STORE BUILDING ELEMENTS. I TYPICALLY DO THIS ON THE SECOND LAYER WHICH I SET TO RED SO I CAN TELL IT APART FROM EVERYTHING ELSE

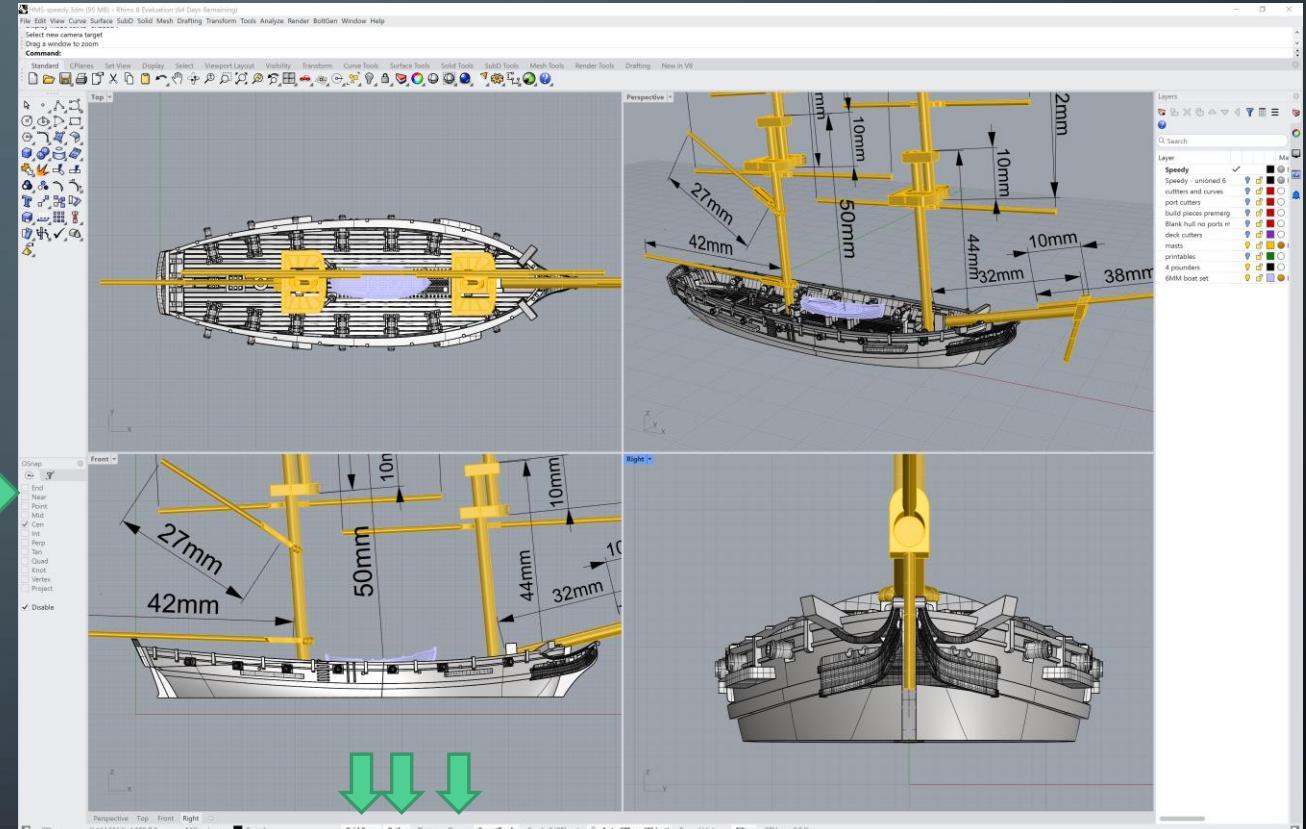


# RHINO OVERVIEW - BASICS

DOWN AT THE BOTTOM  
ARE MODELING AIDS  
CALLED "SNAPS"

IT THEY ARE BOLD THEY ARE  
TURNED ON

IF YOU ARE NOT USING  
THEM TURN THEM OFF... AS  
SNAPS IN THE WRONG  
PLACES WILL CAUSE YOU  
TO DO THINGS YOU DON'T  
EXPECT

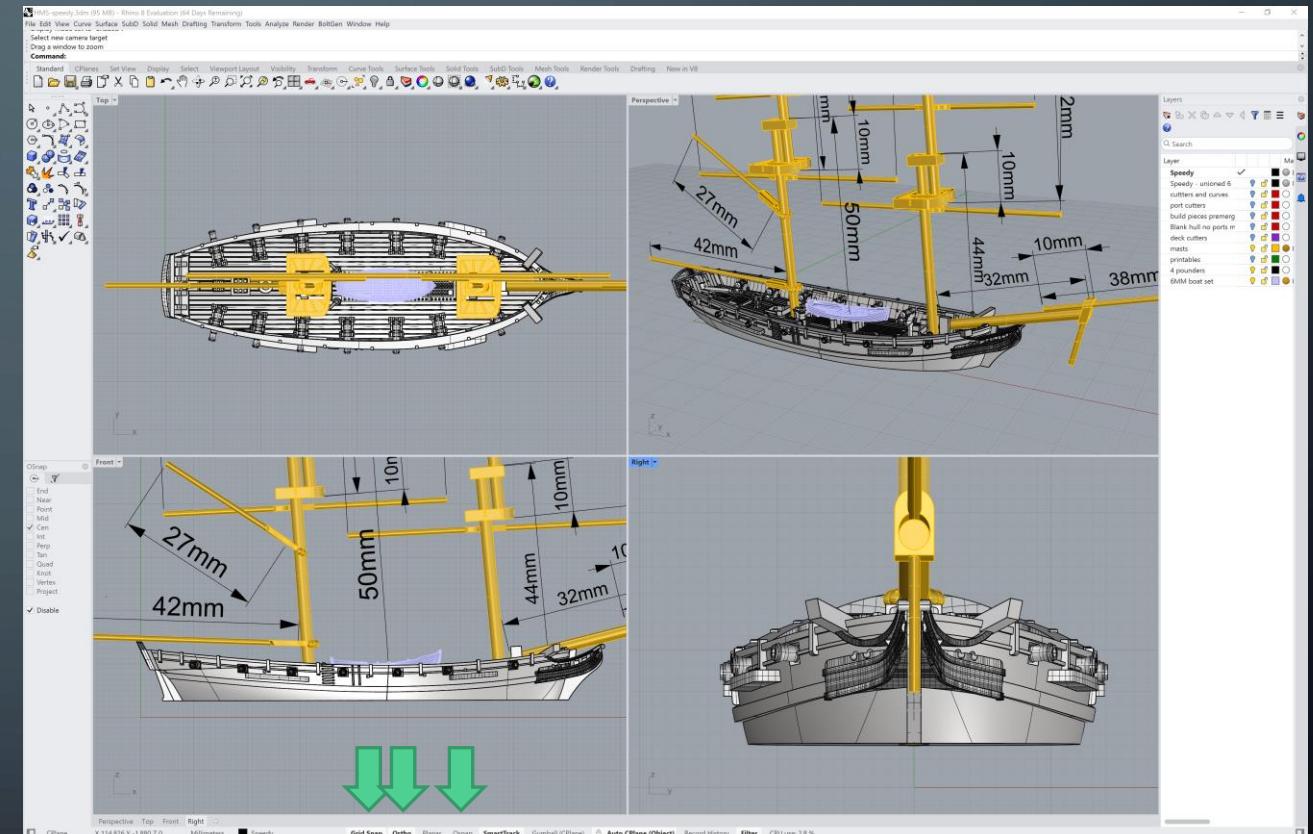


# RHINO OVERVIEW - BASICS

GRID SNAP SNAPS TO THE  
INTERSECTIONS OF THE  
PLANAR GRIDS

ORTHO BY DEFAULT SNAPS  
TO STRAIGHT LINES AND  
90-DEGREE INCREMENTS

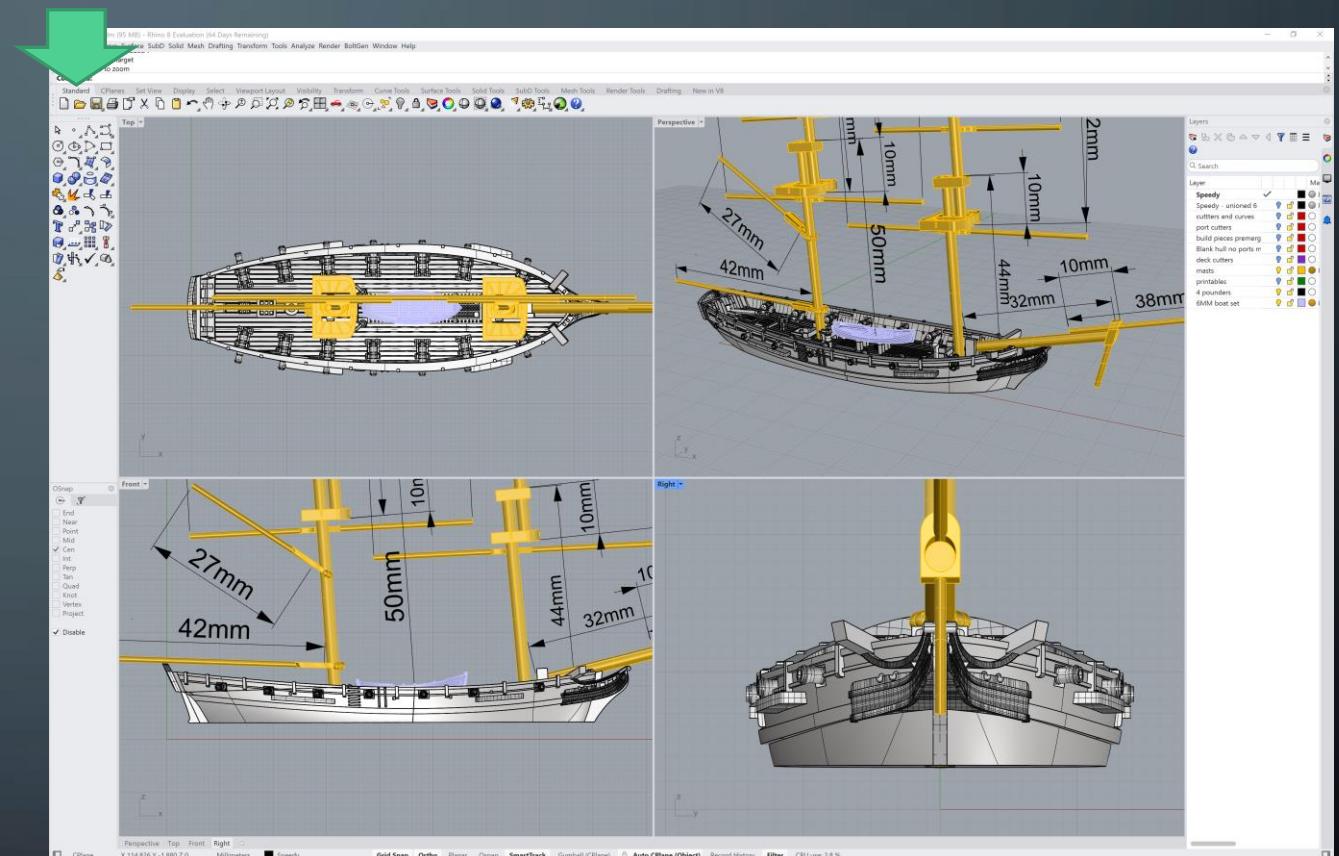
O-SNAP (OBJECT SNAPS)  
SNAPS TO WHATEVER  
CHECK BOXES YOU SELECT



# RHINO OVERVIEW - BASICS

UP ABOVE THE VIEWPORTS ARE CONTEXT SENSITIVE TABS... AS A BEGINNER IT'S BEST TO MAKE SURE WE ARE ALWAYS ON THE STANDARD TAB.

IF YOU ARE SEEING DIFFERENT BUTTONS THEN THE WALKTHROUGH, CHECK TO MAKE SURE YOU STILL ARE ON THE STANDARD TAB

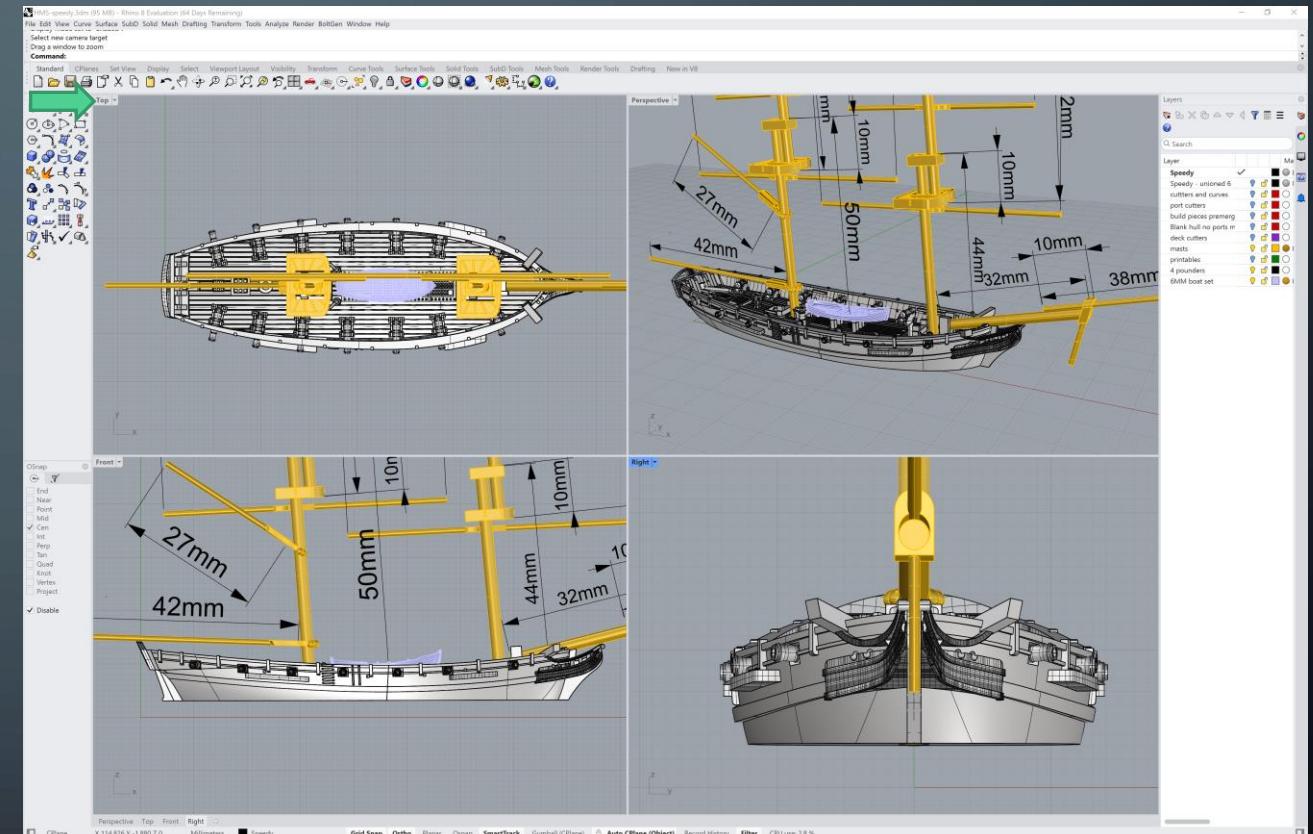


# RHINO OVERVIEW - BASICS

YOU'LL ALSO NOTICE EACH  
VIEWPORT HAS A LABEL AND A  
DOWN ARROW THAT WILL POP A  
MENU FOR THAT VIEWPORT...

YOU CAN CHANGE THE VIEW  
TYPE HERE (I USE SHADED OR  
GHOSTED MOST OFTEN)

IF YOU DOUBLE CLICK THE LABEL  
THE VIEWPORT GOES FULL SCREEN  
AND IF YOU DO IT AGAIN IT WILL  
RETURN TO THE 4 -VIEWS



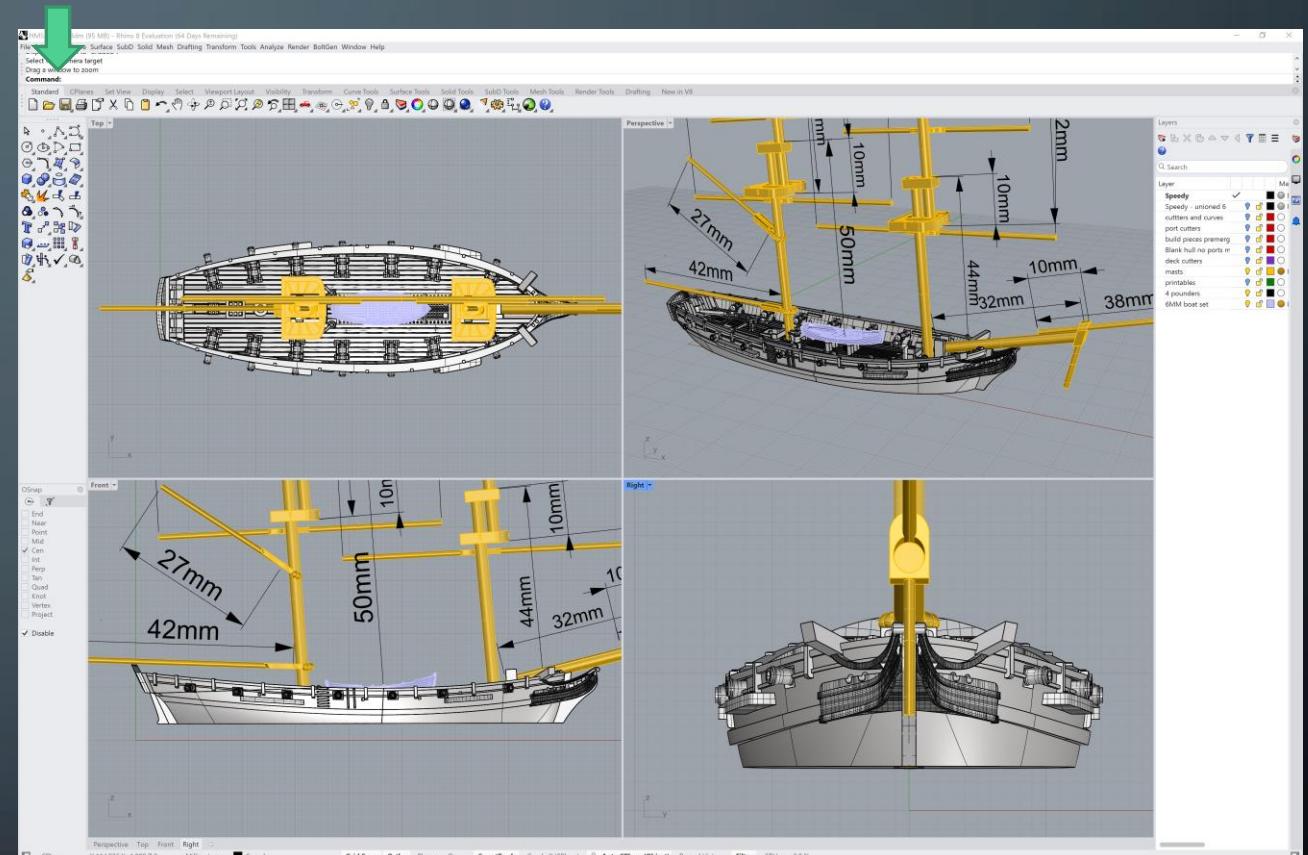
# RHINO OVERVIEW - BASICS

ONE LAST NOTE...RHINO IS  
COMMAND DRIVEN ... WHETHER  
YOU TYPE A COMMAND OR SELECT  
A TOOL OR MENU A COMMAND  
WILL COME UP AND IT WILL NOT  
COMPLETE TILL YOU HIT ENTER.

...HITTING ENTER AGAIN REPEATS  
THE COMMAND

...HITTING ESCAPE WHILE IN A  
COMMAND EXITS THE COMMAND

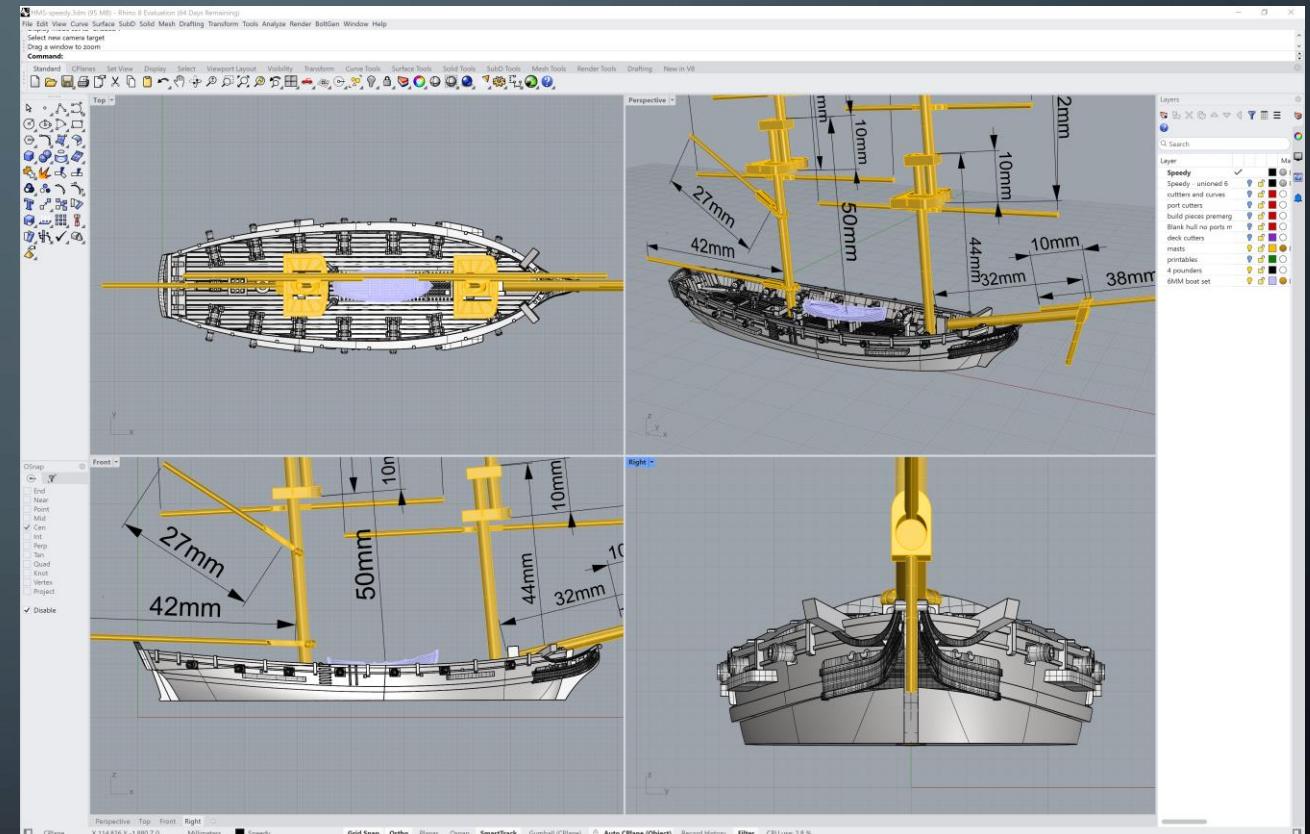
\* PLEASE NOTE THE COMMAND  
BUTTON IS IN A SLIGHTLY  
DIFFERENT PLACE IF YOU HAVE A  
MAC!



# RHINO OVERVIEW - BASICS

ALL COMMANDS IN RHINO  
CAN BE TYPED AT THE  
COMMAND LINE, FOUND IN  
THE MENUS OR ON THE  
BUTTON BARS...

THERE IS NO RIGHT OR  
WRONG OPTION HERE...  
USE WHAT YOU REMEMBER  
AND FEELS BEST – I TEND TO  
USE SOME OPTIONS EACH  
WAY



# RHINO OVERVIEW - CONCEPTS

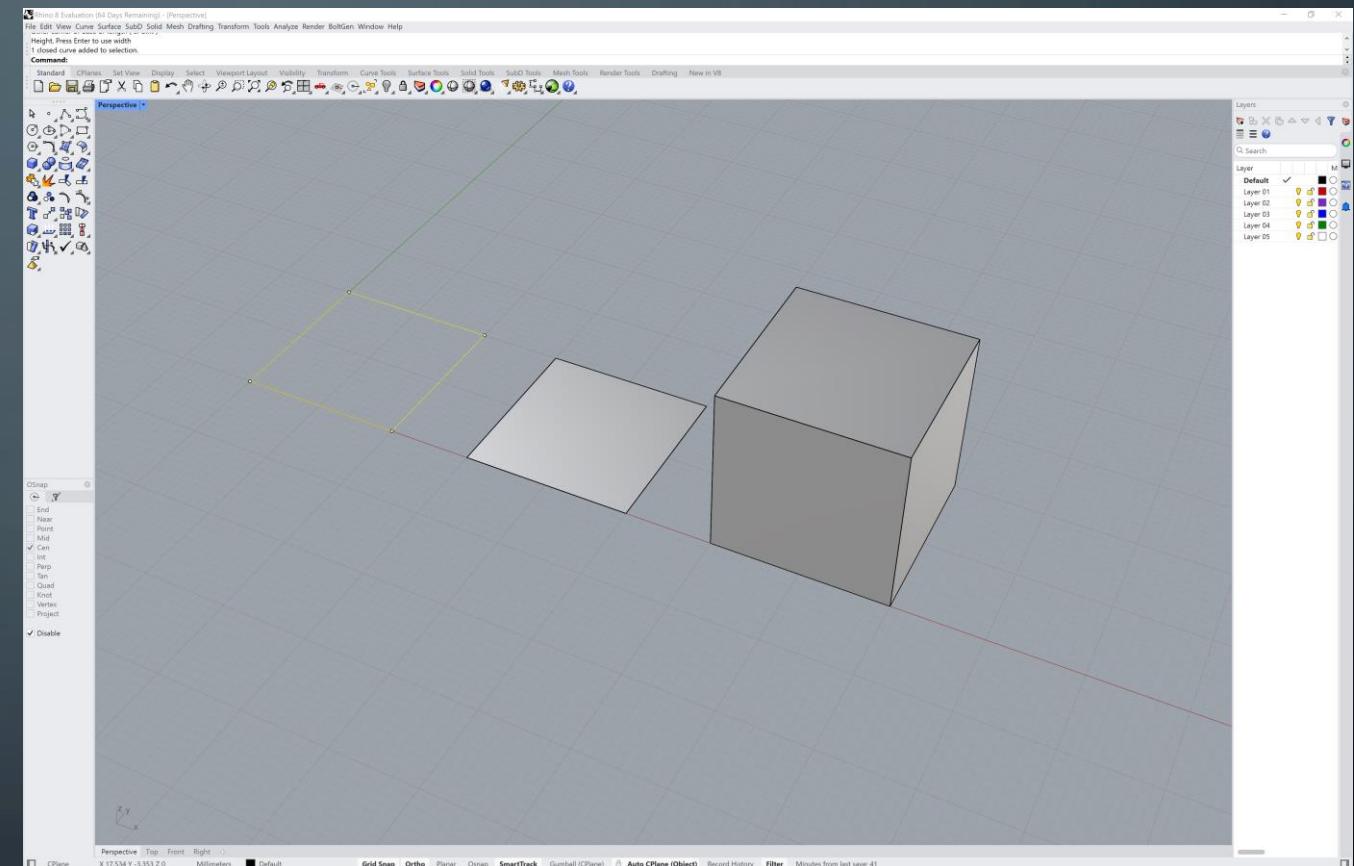
RHINO HAS A HIERARCHY FOR OBJECTS:

THE POINT – A DEFINED POINT IN 3D SPACE. THIS MIGHT BE A DIRECT POINT ON THE MODEL OR A “CONTROL POINT” WHICH IS A POINT THAT INFLUENCES THE MATHEMATICAL PROPERTIES OF OTHER OBJECTS.

A LINE OR CURVE – MATHEMATICALLY SPEAKING LINES ARE CURVES THUS RHINO HAS A LINE COMMAND BUT STILL REFERS TO IT AS A CURVE

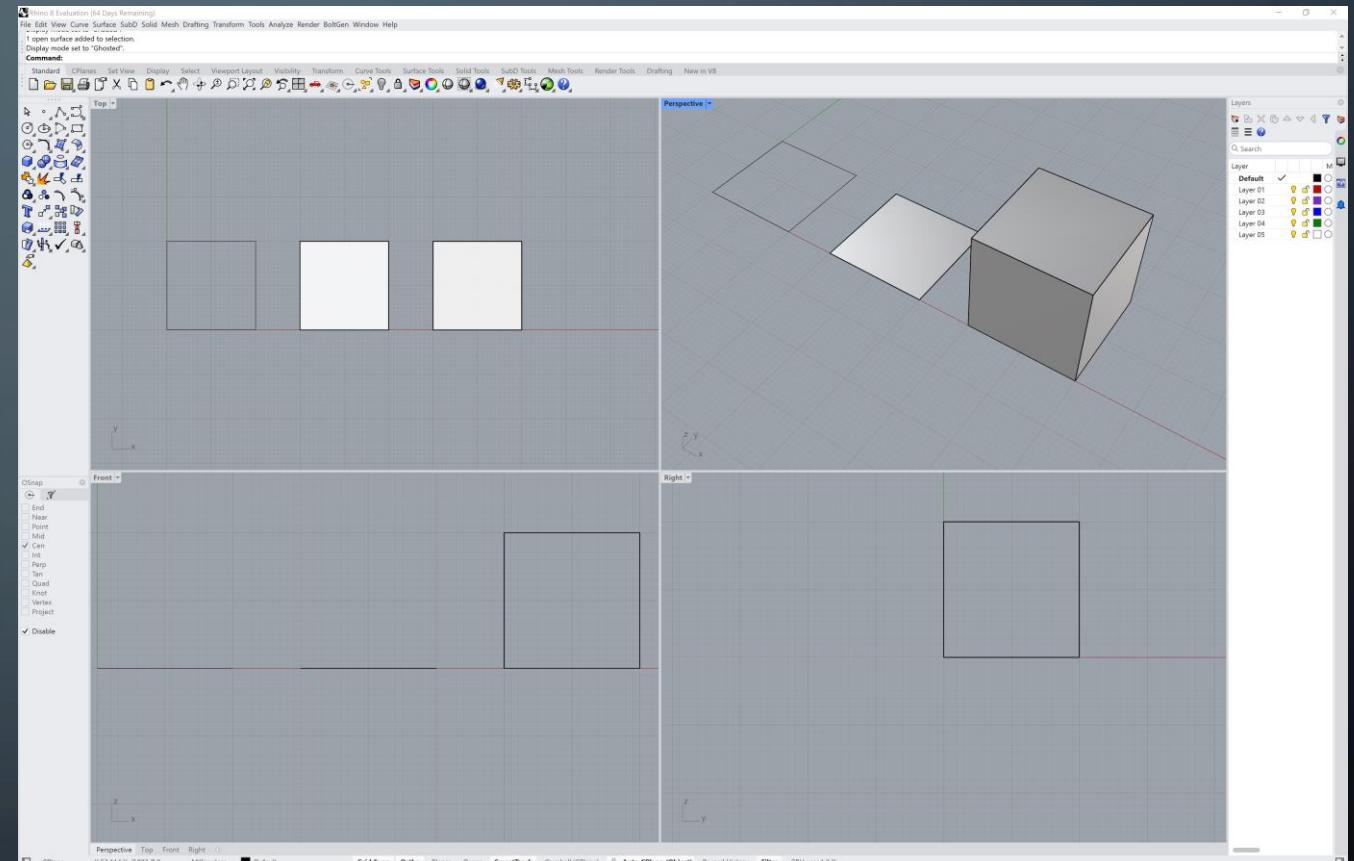
SOLID – RHINO CONSIDERS A COMPLETELY “WATERTIGHT” SET OF SURFACES TO BE A SOLID

IN RHINO, THE CURRENTLY SELECTED OBJECT IS YELLOW



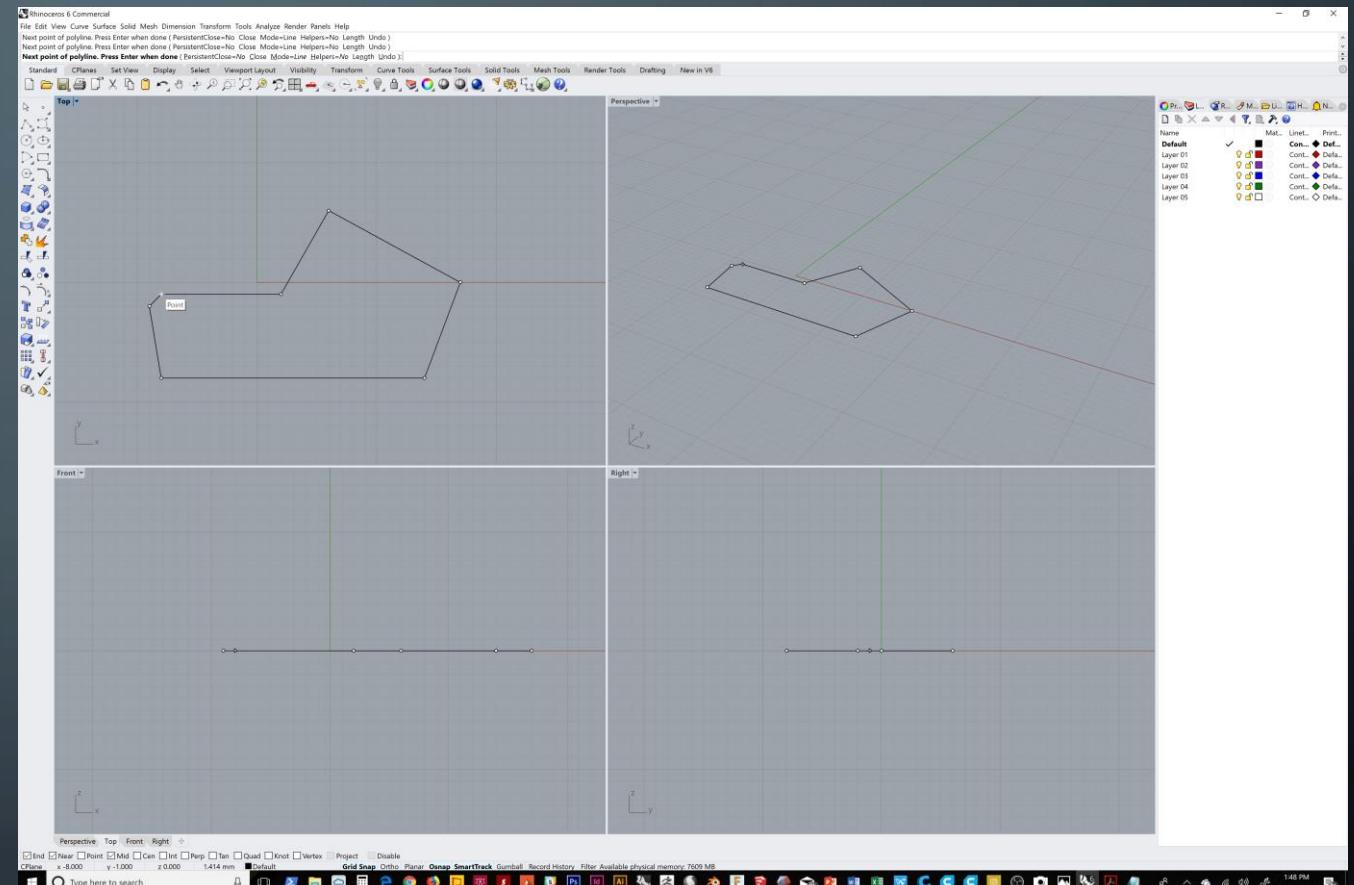
# RHINO OVERVIEW - CONCEPTS

TO BUILD A MODEL WE  
WILL USE THESE BASIC  
OBJECTS TO MAKE AND  
TRANSFORM THEM INTO  
MORE ADVANCED THINGS



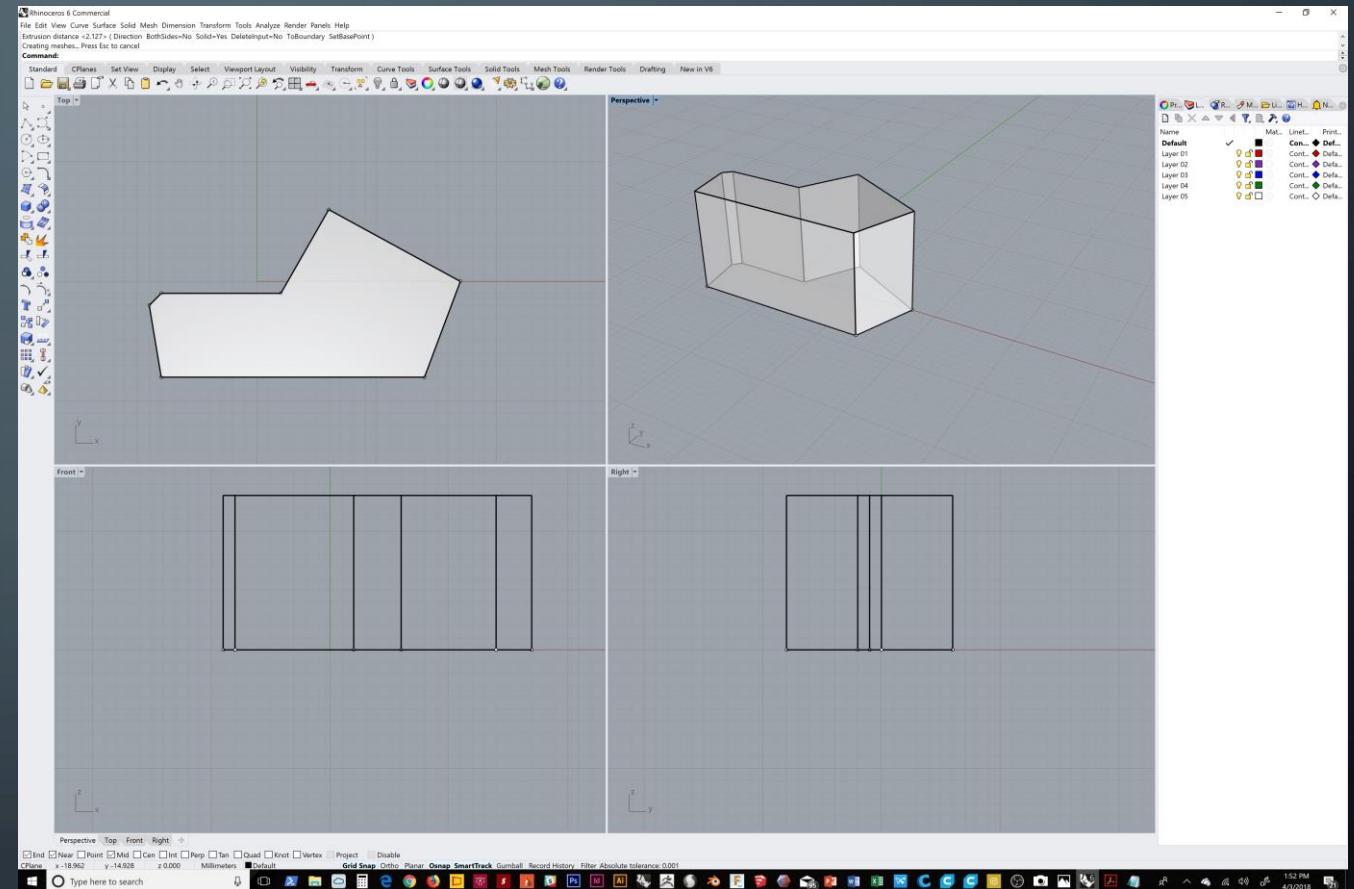
# RHINO OVERVIEW - CONCEPTS

POINTS CAN BUILD LINES  
OR CURVES ...



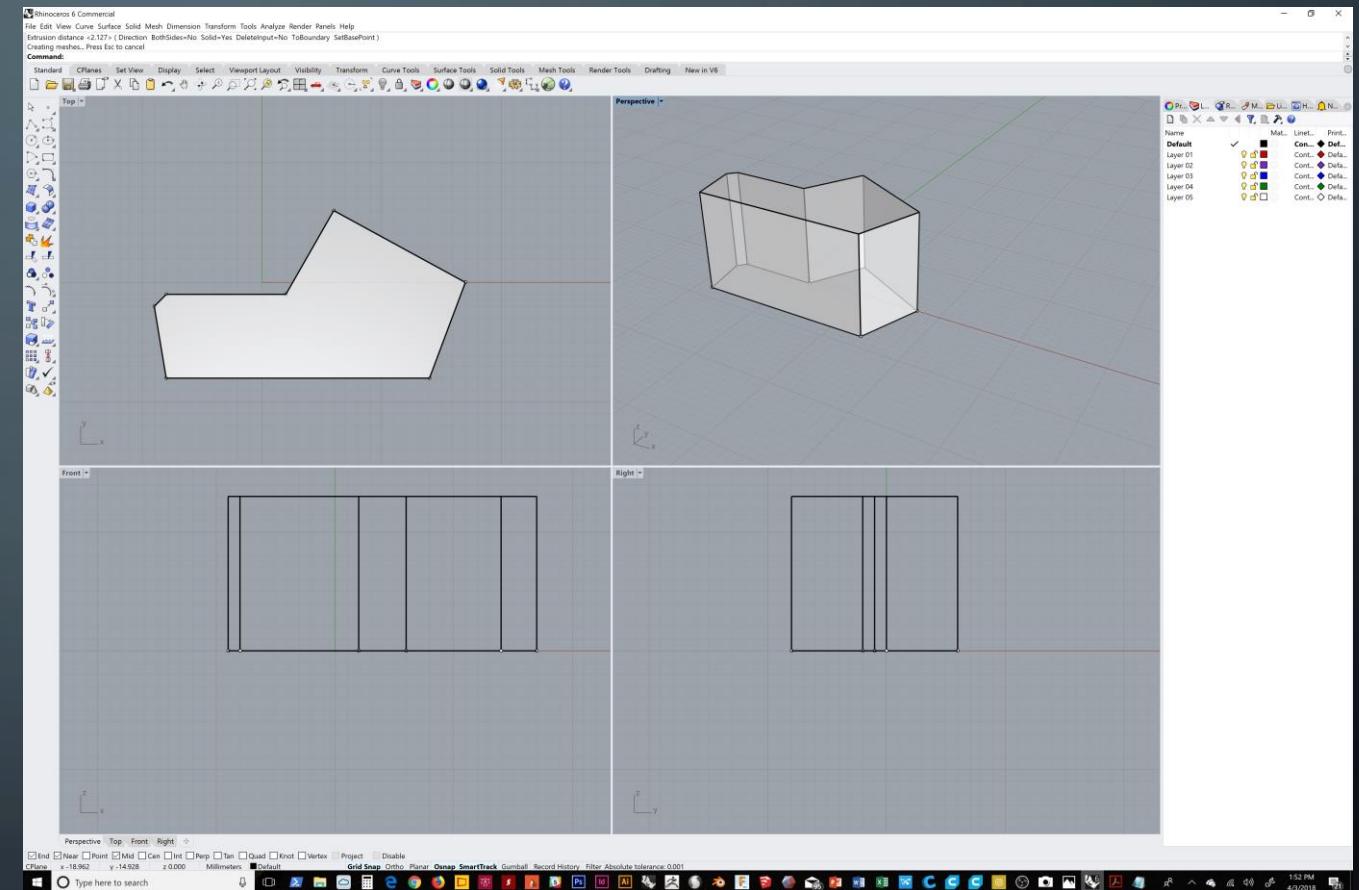
# RHINO OVERVIEW - CONCEPTS

WHICH IN TURN CAN  
CREATE SURFACES AND  
SOLID SHAPES ...



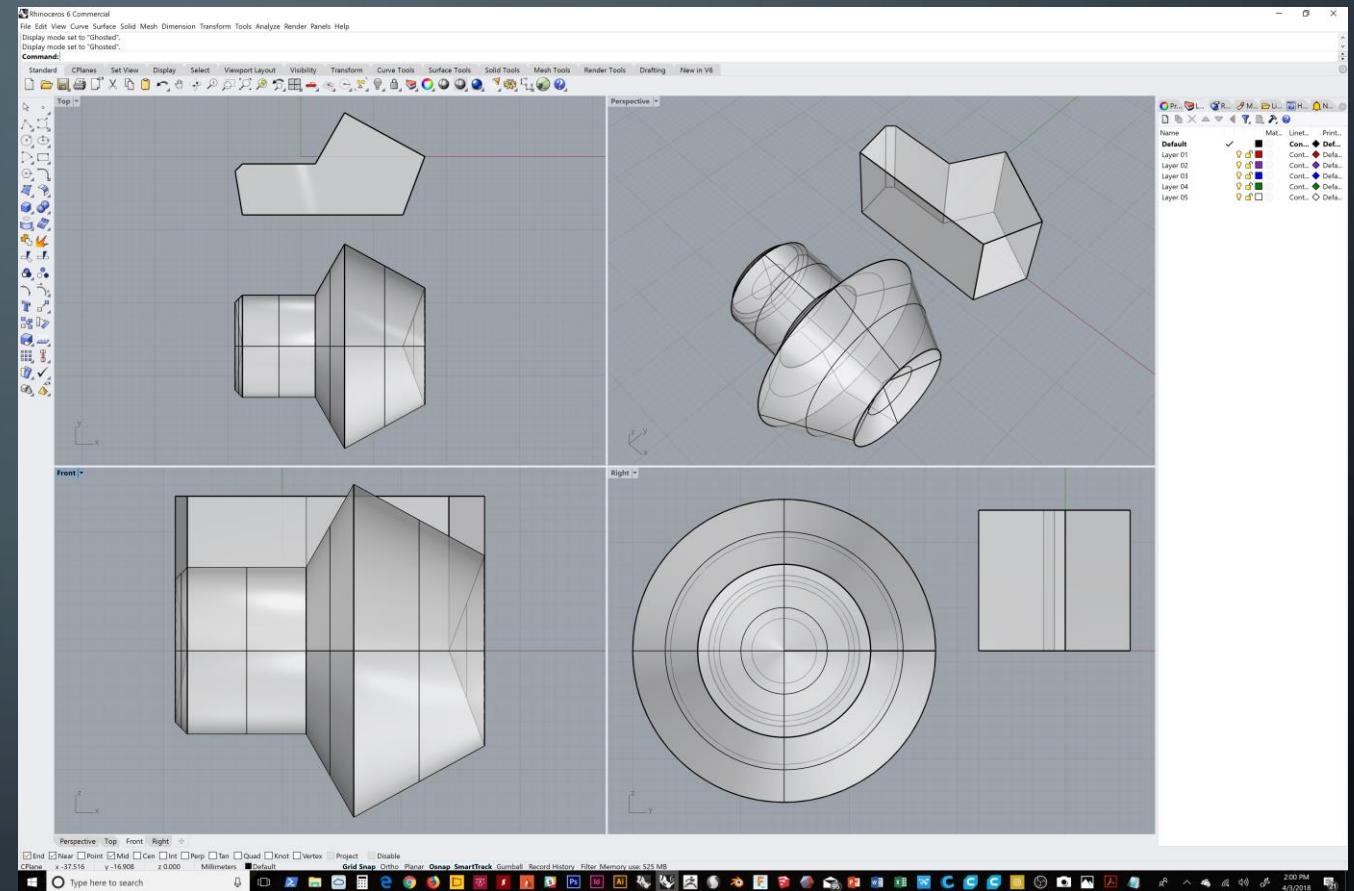
# RHINO OVERVIEW - CONCEPTS

THIS WAS DONE BY  
EXTRUDING THE PLANER  
CURVE STRAIGHT... (UNDER  
THE SOLID MENU....)



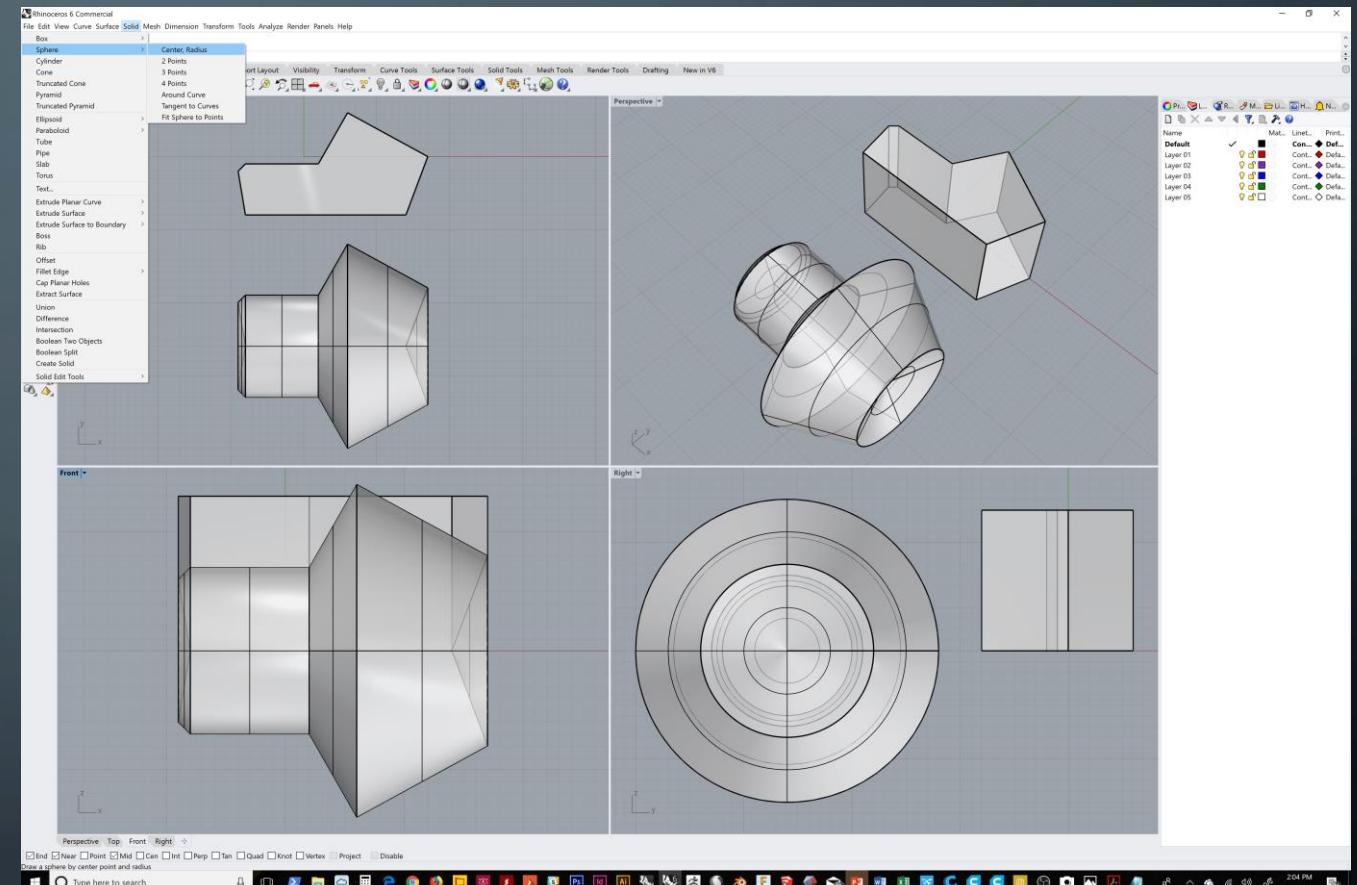
# RHINO OVERVIEW - CONCEPTS

IF I COPY AND PASTE THE  
CURVE (CTRL-C CTRL-V)  
AND DRAG IT... I CAN USE  
THAT SAME CURVE TO  
REVOLVE A DIFFERENT  
SHAPE (SURFACE MENU  
REVOLVE)



# RHINO OVERVIEW - CONCEPTS

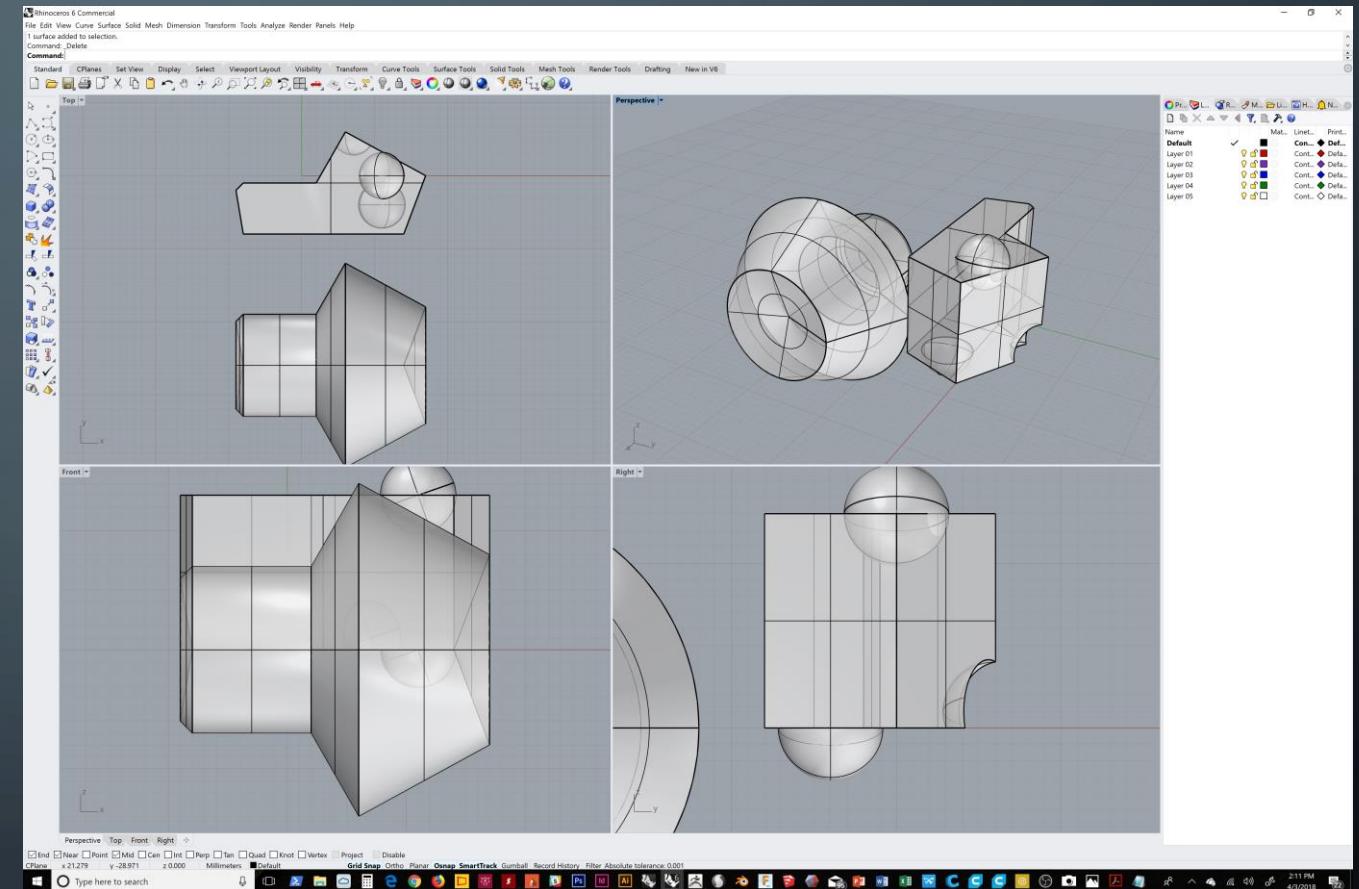
I CAN ALSO CREATE BASIC SHAPES FROM THE SOLID MENU TO ADD DETAILS ...



# RHINO OVERVIEW - CONCEPTS

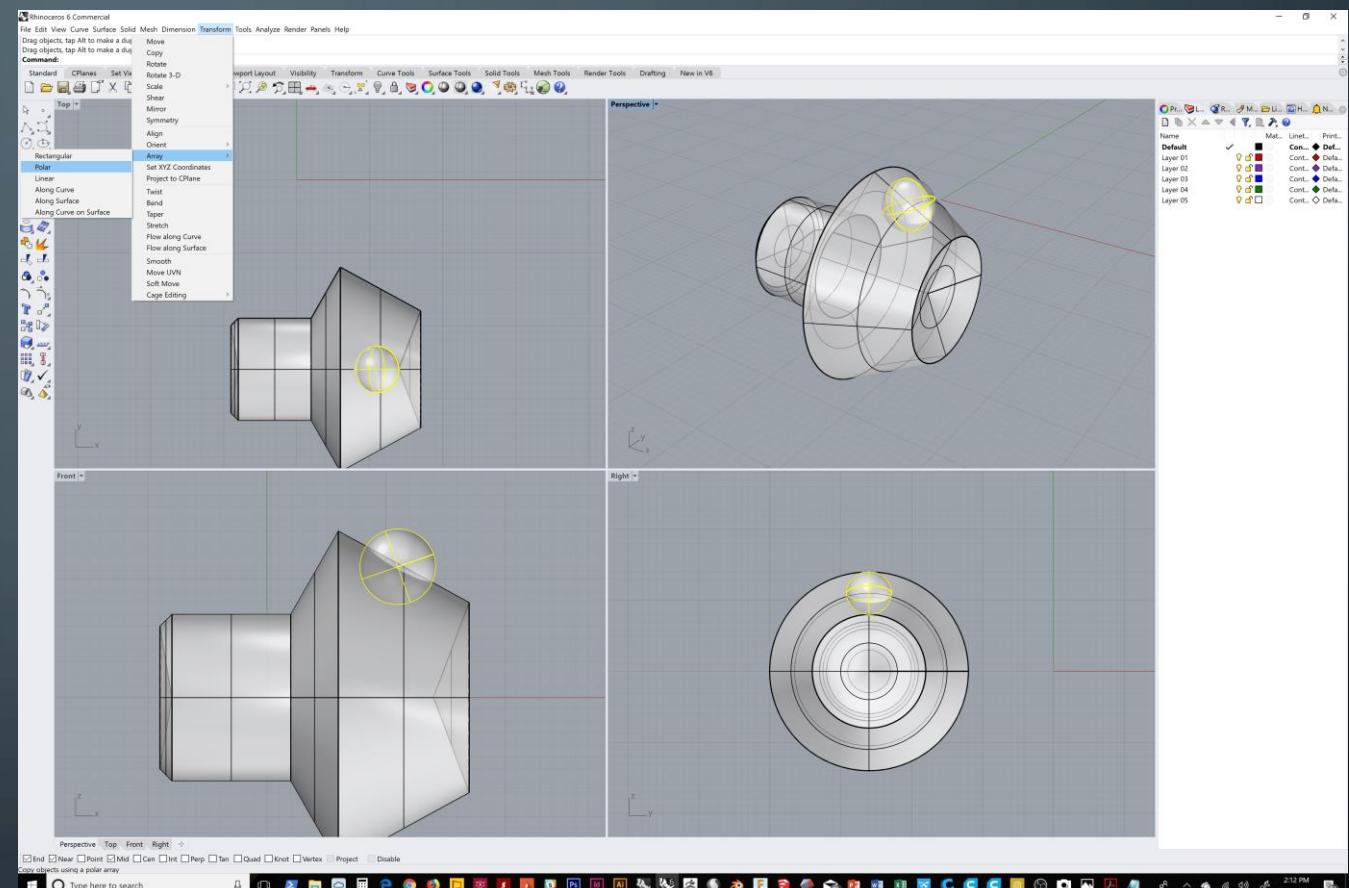
THESE CAN BE ADDED  
TOGETHER OR SUBTRACTED  
FROM EACH OTHER USING  
BOOLEANS... (UNION AND  
DIFFERENCE)

BOOLEANS CAN ALSO BE  
USED TO SPLIT PARTS WITH  
CUTTING PLANES



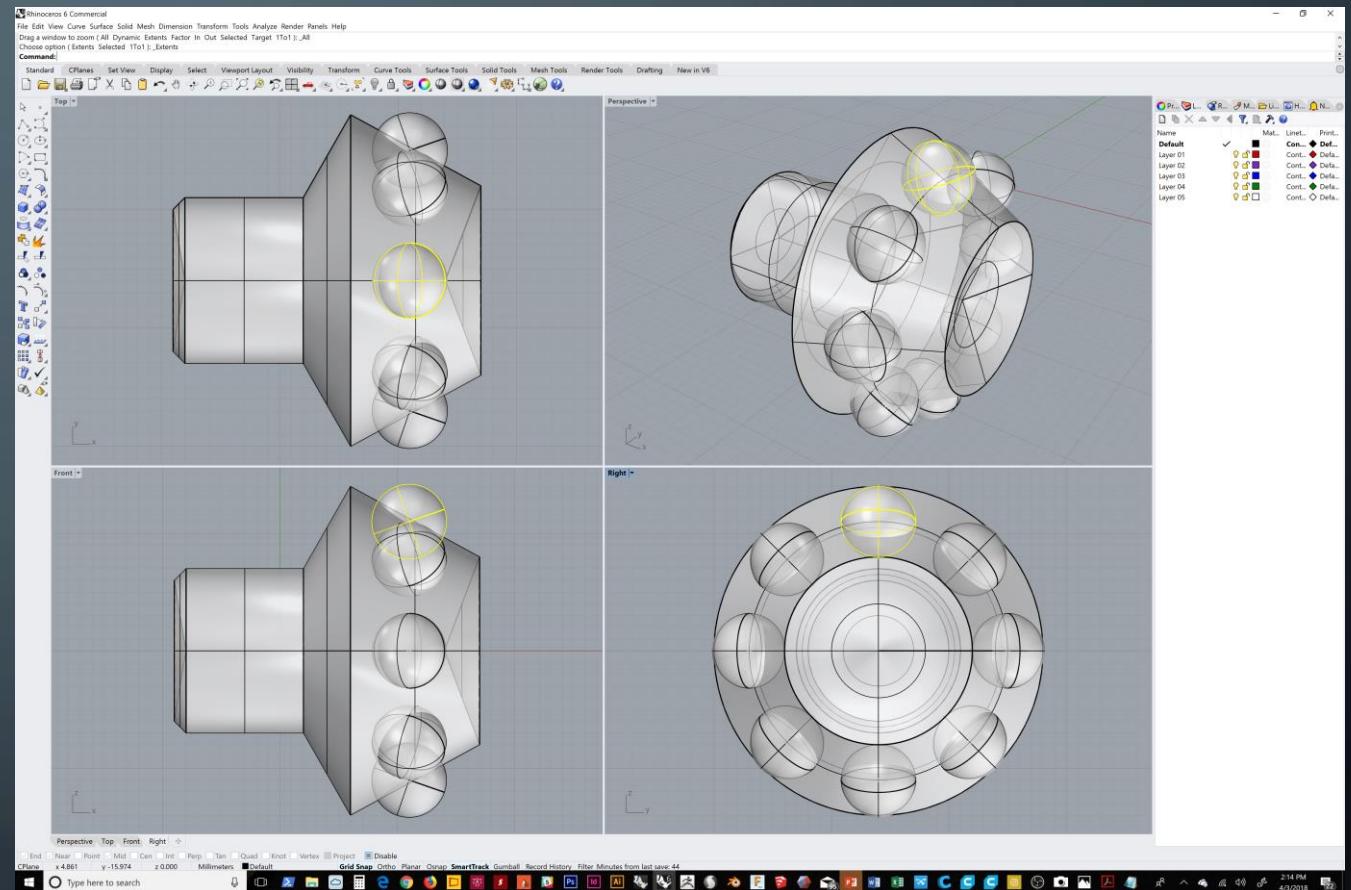
# RHINO OVERVIEW - CONCEPTS

THERE ARE ALSO LOADS OF  
TRANSFORM TOOLS ... WE  
CAN USE A POLAR ARRAY  
TO ARRANGE THE BALLS  
AROUND THE PART ...



# RHINO OVERVIEW - CONCEPTS

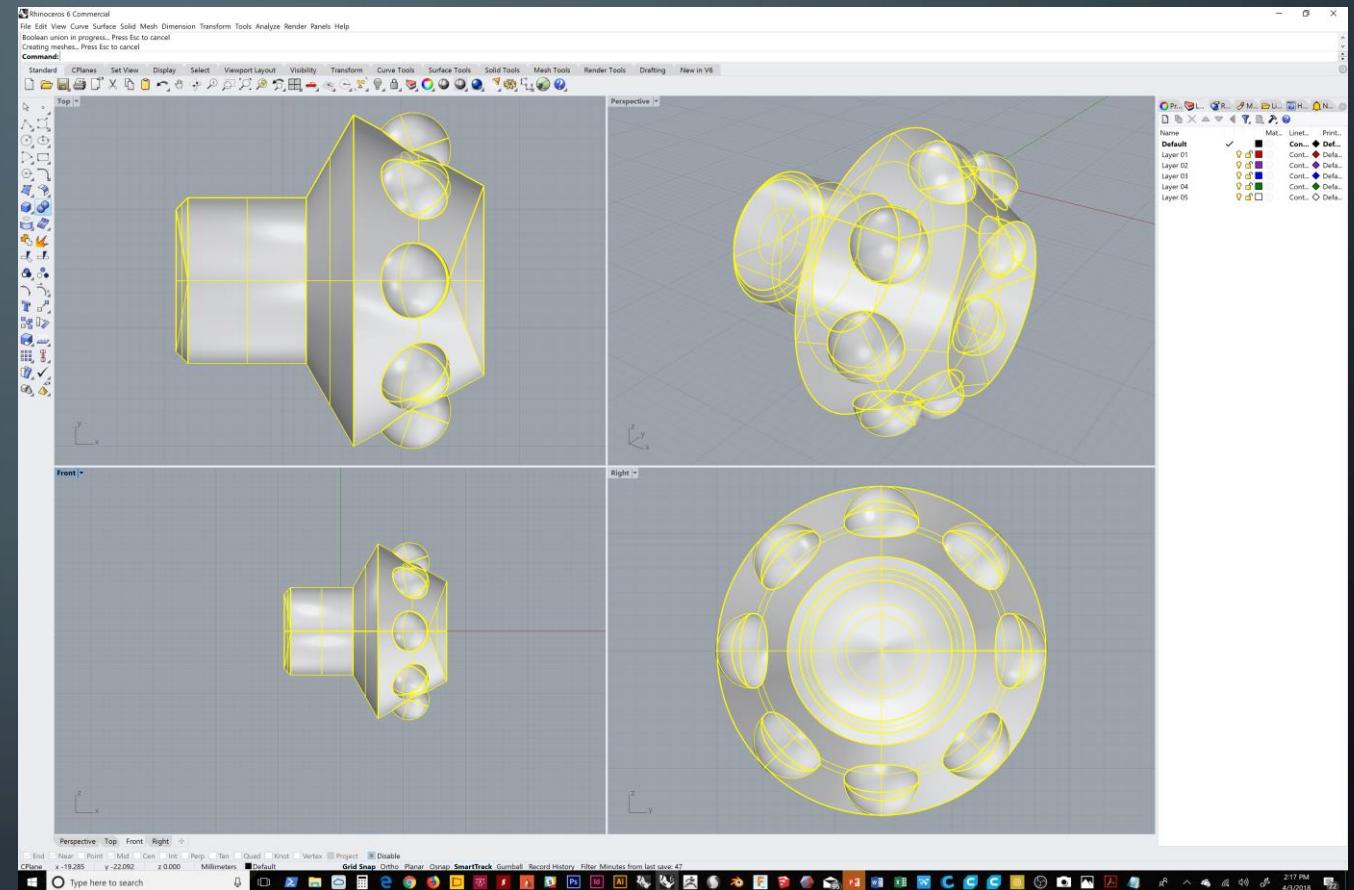
HERE IS 8 BALLS ARRAYED  
360 DEGREES ...



# RHINO OVERVIEW - CONCEPTS

I CAN DRAG LEFT TO RIGHT  
AND SELECT EVERYTHING  
THEN HIT THE UNION ICON  
TO MAKE IT ONE PIECE

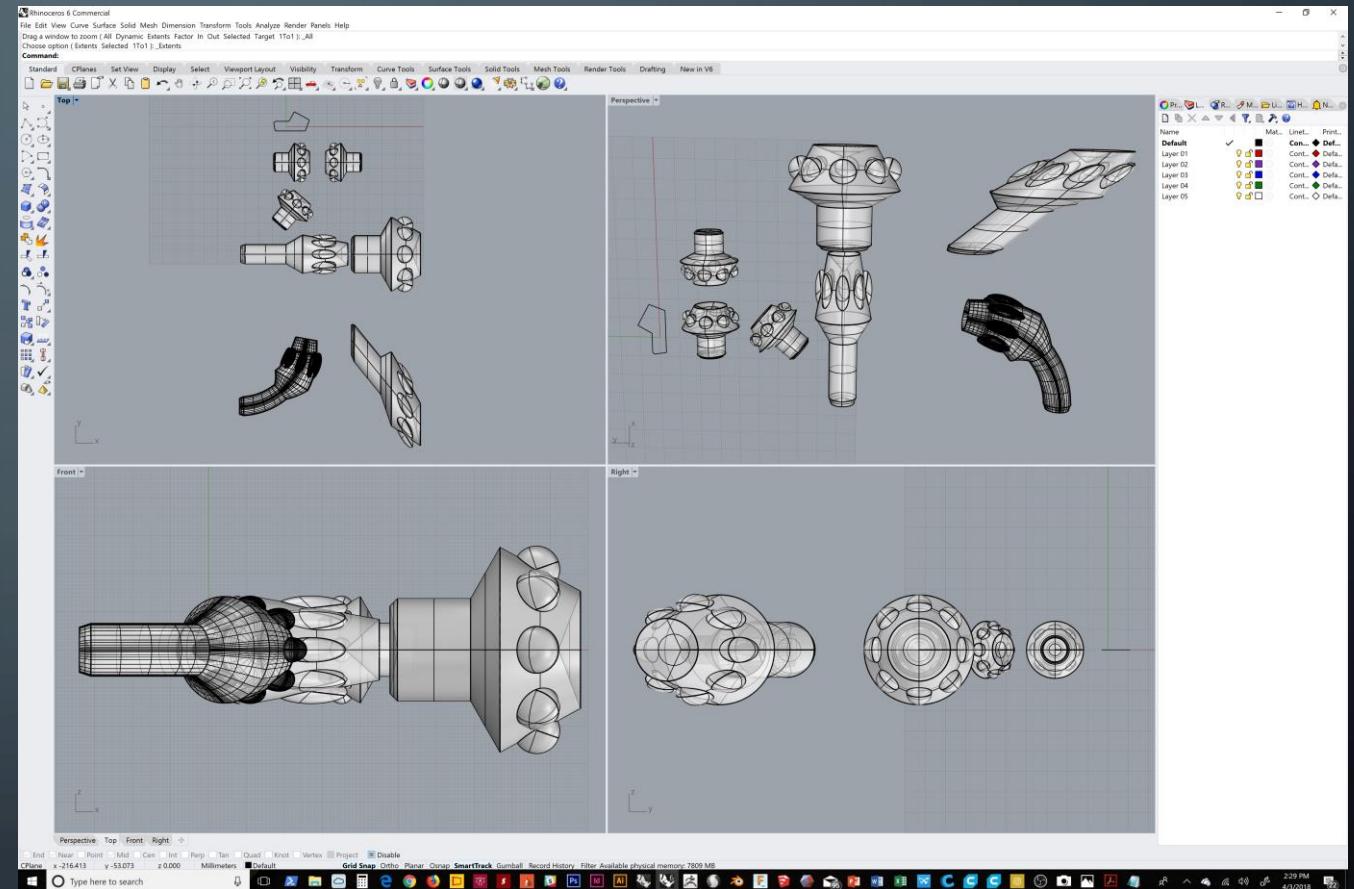
NOTE THAT DRAGGING LEFT  
TO RIGHT SELECTS  
EVERYTHING COMPLETELY  
WITHIN THE DRAG AREA  
WHEREAS RIGHT TO LEFT  
SELECTS EVERYTHING THE  
AREA TOUCHES



# RHINO OVERVIEW - CONCEPTS

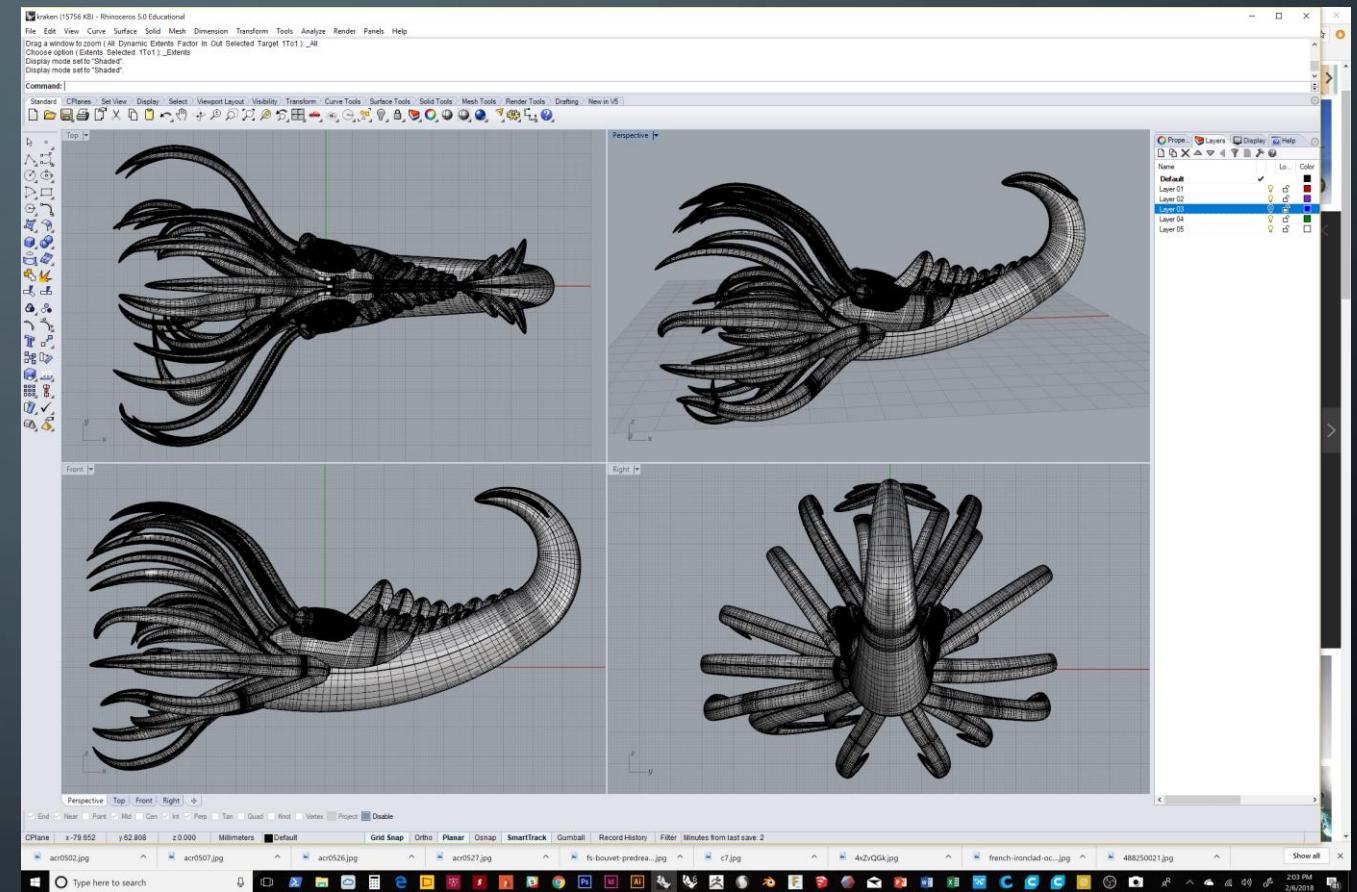
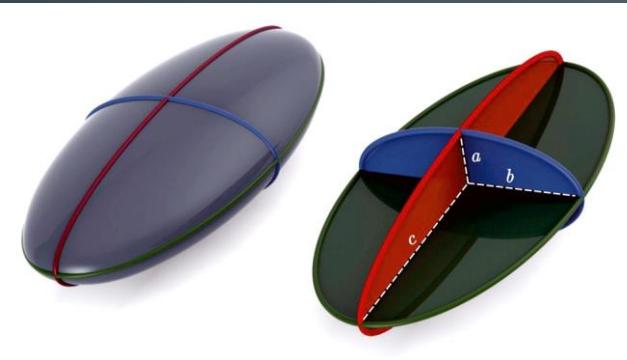
THERE ARE MANY TRANSFORMS INCLUDING MIRRORING, ROTATING, SCALING, BENDING AND SHEERING AND MANY MORE.

ALL THESE SHAPES WERE BUILT OUT OF THE BASIC POINTS AND CURVES FROM BEFORE!



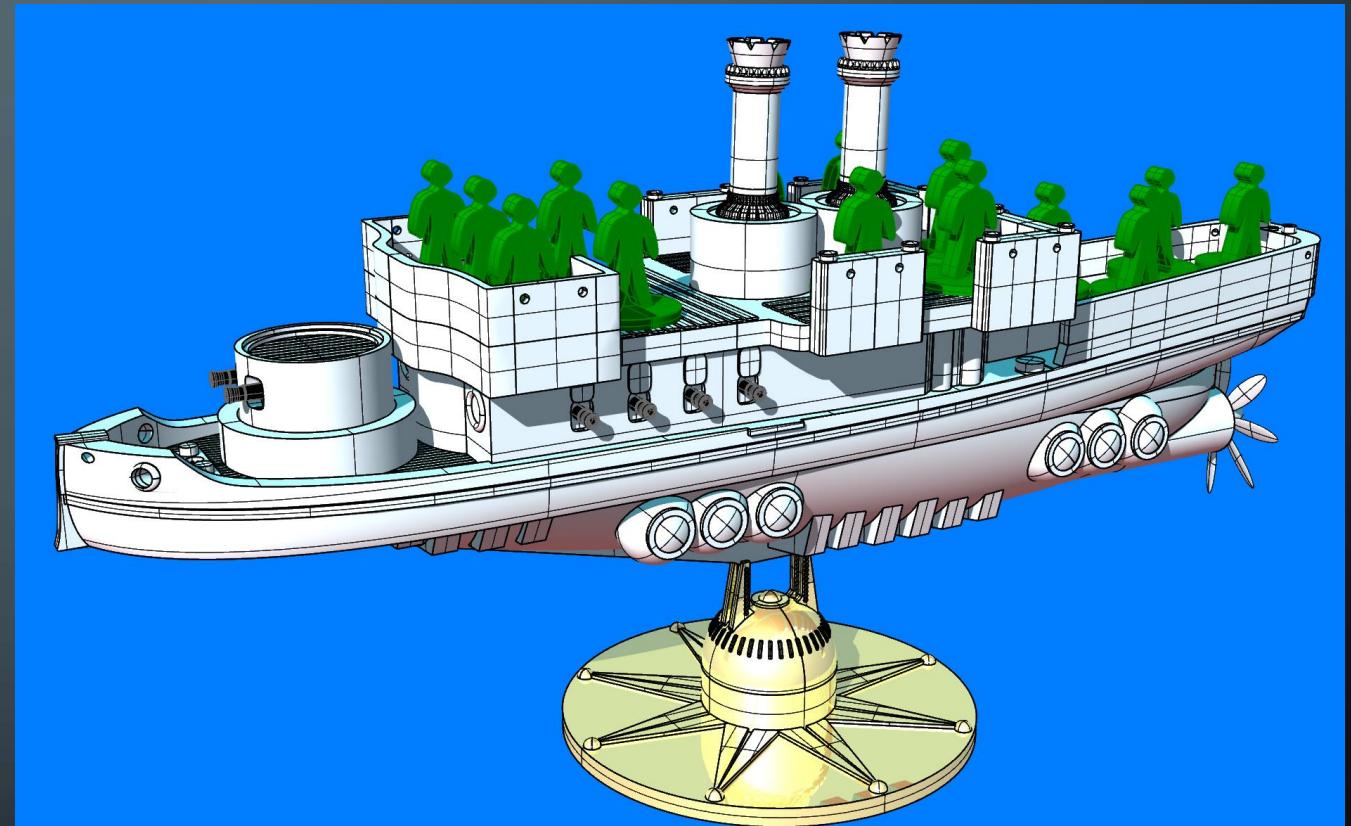
# RHINO OVERVIEW - CONCEPTS

THIS MODEL IS BUILT  
COMPLETELY OUT OF  
ELLIPSOIDS!



# RHINO OVERVIEW - CONCEPTS

THE SKY IS THE LIMIT!



# RHINO OVERVIEW - CONCEPTS

ONCE WE BUILD A MODEL,  
WE CAN PRINT IT BY  
EXPORTING IT TO A .STL FILE  
AND OPENING IT IN A SLICER  
(CURA SHOWN HERE)

THIS WILL BREAK YOUR  
MODEL INTO PRINTABLE  
LAYERS AND TELL US HOW  
LONG IT WILL TAKE TO PRINT!



# RHINO OVERVIEW - CONCEPTS

LET'S BUILD SOME MODELS !

