Here is the step by step 6 volt to 12 volt report you requested from http://vintageautogarage.com

For a printable PDF version of this report go to this link http://vintageautogarage.com/6v12vinstructdownloadpage.html

Before we get into how to convert your car, truck, tractor from 6 volts to 12 volts, let's discuss some basic electricity.

Electricity works the same as water, the battery source acts like a reservoir and provides the pressure and volume, the wiring is the hose and nozzle is the resistance, diodes are like one way water check valves.

Here is the way electricity works: When you double the voltage or increase the capacity of the water tank you decrease the pressure or amperage needed to drive an electrical device. In the case of taking a 6 volt system to 12 volts, you are doubling the voltage thus decrease the amperage in half. This is why you can use the same size wiring in a 12 volt system as you have in a 6 volt system. This means that you don't need to rewire your vehicle when converting to 12 volts provided your wiring is in good shape.

So no need to re-wire your car with different size wire.

Some electrical terms:

DC       Direct Current
AC       Alternating Current

Series Wiring: Like a sting of old Christmas tree lights, one goes out they all go out.

Parallel: Wired like your home lighting system each light is powered individually.

Volts: Pressure of electricity

Amps: Volume of electricity (this is what does the work)

Watts: Amount of electricity used or needed to power a device

Resistor: Device that controls the volume of electricity, acts like a hose nozzle
Capacitor: Device that stores electricity for short periods of time.

Diode: allows current to flow in one direction only.

Those that are interested:

Ohm's Law defines the relationships between (P) power, (E) voltage, (I) current, and resistance. One ohm is the resistance value through which one volt will maintain a current of one ampere.

Knowing this formula you will be able to figure the various load and power requirements in your vehicle.

Now lets talk about safety, your safety. You can become badly injured working around electricity; you may not think 6 volts or 12 volts can hurt you, I am here to tell you that is not true. A Battery can pull lots of amps if you get in between the positive and negative and the situation is right. You can get badly burned or even worse. Anytime you work around your vehicle electrical system always un-hook the battery terminals and be careful when removing the terminals, one time when I was un-hooking the terminals on the battery I melted a 9/16 wrench when the wrench shorted across the terminal and the frame. I still have the wrench in my tool box to remind me just how 12 volts can do real damage.

Lets discuss positive versus negative grounded systems:

Ford, Dodge Brothers Studebaker and others wired there earlier automobiles with the positive terminal from the battery to ground or frame and the negative went to the ignition switch and the starter. Chevrolet and GM always wired there vehicles with negative grounds.

After the late 50’s early 60’s most every manufacture went to negative grounded electric systems.

When doing your conversion from 6 volt to 12 volt you will want to switch your systems to negative ground by changing the terminals on the battery, the negative to the chassis and or engine and the positive is going direct to the starter solenoid and ignition switch.

Remember all modern auto electrical systems are negative grounded systems and all solid state radios and other solid...
state accessories are designed with negative ground systems. If you want to plug in your smart phone or music player you will need negative grounded system.

**SPECIAL NOTE:**
You will toast a solid state radio or any solid state component if you run positive ground. If you are working on a GM product you can skip this step.

For the positive ground vehicles, lets remove a myth about starters turning backwards when changing from pos to neg. ground, I get this question all the time.

When you change polarity your starter will NOT turn backwards and most 6 volt starter will work just fine on 12 volts and reversed polarity, plus 12 volts will start your hot, or cold engine every time. Yes, the starter will turn much faster with 12 volts. You may need to adjust the starter drive clutch to keep the starter from activating to quickly into the flywheel. Most starters have adjustable pilot screws to adjust the drag on the starter drives, by turning the screw in, you can increase the drag on the starter clutch. If you find you can’t adjust this screw to increase the drag, you may need to replace the starter drive. One of the biggest benefits in converting to 12 volts is the ability to have more battery cranking energy and a must for higher compression engines.

Lets get started; start by un-hooking the 6 volt battery and removing from the vehicle, remove the 6 volt voltage regulator ignition coil and generator.

You have an option to either convert your generator to 12 volts or install a modern alternator with built in voltage regulator.

I will show you both ways.

The advantage of converting the generator to 12 volts is the original look under the hood, realize this may take longer and may require a generator shop to convert or you want to tackle this yourself. Here is link to find generator convert parts.

http://vintageautogarage.com/g12vk-cae.html

The disadvantage of a generator is the inability for the generator to produce current at low engine speeds, you may need to be driving at 20-30 MPH before your generator kicks in, this means at idle speed you are running off the battery.
The advantage of an alternator is the ability to generate higher amperage at a wider range of engine speeds and the weight to power ratio is much greater with an alternator.

The disadvantage of an alternator is you can not charge a dead battery. Why? because alternators unlike generators require a fully charged battery to excite the field coils within the alternator. That is why you need to completely charge your battery when installing an alternator.
The good news is the battery will stay charged with an alternator at most all engine speeds.

Installing an alternator will allow you to run more accessories like electric fans and air conditioning. NOTE: if you plan to install A/C you should select 12V 100 amp alternator the cost is not that much greater. Link to alternators:

http://vintageautogarage.com/alternator.html

Modern alternators come in a couple of wiring configurations:

1 wire hook-up and 3 wire hook-up. GM style alternators which is the most common alternator used in conversion as they are simple to install and you can find generator to alternator adaptors for most every engine configuration.

http://vintageautogarage.com/altbkts.html

I mentioned earlier that alternators will charge at normal engine RPM levels, and that is generally true for the engines that the alternators were designed to work with.

Here is the catch you are adapting an alternator onto an engine that it was not designed for, and the alternator needs to turn at specific speeds to generator power. Alternator internal regulators are set to turn the alternator on and off based on alternator RPM, generally around 600 RPM engine speed and the alternator rotation speed depends on the alternator and engine pulley size. You want to have at least 2:1 ratio on your pulleys, engine at least 2 X larger than the alternator pulley. Said in a different way, if your alternator pulley is 3’’ in diameter your engine pulley should be at least 6’’ in diameter.
Note: The pulleys on most alternators from local parts stores come with narrow pulleys installed to work with modern narrow belts. Your engine may have a wide belt, it is easier to replace the alternator pulley to work with your wider belt system. here is link to see different size pulleys, these are generally easy to replace.
http://vintageautogarage.com/altpulley-cae.html

Alternators and regulartors are not all built the same way, meaning you can have an alternator built for a modern engine and the alternator produces energy at idle because the engine and pulley sizes are correctly matched.

Now take that same alternator and put on your older engine that was not matched for the alternator and the alternator may not produce current at your engine idle speed and you may not be able to get the pulley sizes correct for this reason
If you are buying a GM style alternator at you local parts store you should always buy a 3 wire.

Here is why.

We figured out you can trick the alternator regulator to turn on at lower RPM by externally energizing the alternator field coils. This is done by using an external voltage source connected to the internal voltage regulator via the same connector that is used to turn the idiot light on and off. By doing this trick your alternator will turn on at low RPM and your headlights will not go dim at idle. Next time watch older vehicles lights at idle versus at running speeds. If the alternator is working correctly lights should be bright all the time and not dim at idle. If they do dim then the alternator is turning off at the low engine speed and not producing power and running off the battery which you don’t want.

This 3 wire trick uses a special DA plug that snaps into the top back of the alternator, it is located under the dust cover. If you remove the dust cover and there is nothing to connect to, then you have a true 1 wire alternator.

If you do have a 3 wire alternator with 2 pins under the dust cap, then snap the DA plug into the back of the alternator, one of the wires goes to switched battery source like the + side of coil and the other wire connects to power output 10/32 connector on back of alternator. NOTE this works on 6 volt + or - alternators too.

Note: Installing the DA plug and wire setup you need to have a special DA plug and not one that you buy at the local parts store.

Why? because if you install just a wire without a
diode in the wire that goes to the battery or coil you will find your battery will most likely drain back through the alternator and will find your battery dead in the morning. Also you could have a problem turning your engine off as the alternator will keep your coil hot and you can’t shut your engine off. This is true with older style ignition on/off switches found in older vehicles.

Only use Diode style DA plug:
Here is DA plug you should install to get all the features mentioned above.

http://vintageautogarage.com/daplug1.html

Note: if you know you have the correct pulley sizes and can turn the alternator fast enough then you can install a 1 wire alternator and have it work trouble free.

If you have a no charge light on your dash or idiot light, you need to install a 3 wire alternator to ensure you can activate this light. You can use the same DA plug as mentioned above and wire to your dash idiot light.

Here is link to see various alternators:

http://vintageautogarage.com/alternator.html

Simple way of testing an alternator after install: With the engine running take a pocket knife or screw driver and touch the back of the alternator external bearing surface. if the alternator is working you will feel magnetic pull, if not then your alternator is not producing current.

If you want alternator power and keep your vehicle 6 volts positive or negative ground, go to link below to see 6 volt alternators, we make the very best on the market. Remember you can use the DA plug with 6 volt + or - grounded systems does not matter.

http://vintageautogarage.com/alt6v.html

Hope this section helped clear up some questions around alternators and wiring configurations.

Ammeter, we recommend keeping the original ammeter in place and working. These meters are not always that accurate but do allow you to know if the charging system is working and keeps your dash original. Most of the
time the ammeter is wired in series coming from the battery side of
the voltage regulator. When converting to alternator you want to
connect the output alternator wire to the ammeter. If you are
converting from
positive to negative grounds reverse the two wires on the back of

the ammeter so the meter reads correctly. In the case of Fords,
reverse the loop of wire on the back of the gauge. (If you fail to
reverse the wires on the amp gauge nothing bad will happen, your
gauge will just read backwards...) The only exception is 1939-1940
Fords that use a Buss Bar type Ammeter DO NOT change anything and
this style of Ammeter gauge will work fine.

If you prefer to use your original generator here are some tips:

To convert the generator you will need to disassemble the generator
and change the field coils to 12 volt coils. Disassembly of the
generator is straight forward; the most difficult area is the
removal of the square headed screws (2 of them) that hold the field
coils. You will need a special wrench to remove these, if hard to
remove carefully heat the area around the screws; this will loosen
the years of dirt and varnish that has built up. After you get
the coils out you can clean and paint the housing. Now install the
new 12 volt field coils (Vintage Auto Garage can supply these coils
along with new brushes) the same way you removed the old ones. Or
you can
also take your generator along with the parts to a local
machine/generator shop to remove the screws.
Careful not to damage these square headed screws, they
can be hard to find.

Next use 400-500m grit zinc oxide paper to clean the commentator
segments. These
are the copper segments that the brushes ride on. Also clean
between the segments, us a square file or a small blade to
clean in between the segments. To check that your generator
armature is not shorted, use an ohm meter to check from the
commentator to the armature, touch the copper segments to the end
of the bearing shaft, you should not get a reading. If you do,
there may be a short in the armature and you will need to replace
it. If your generator worked when removed, then it should work
after you convert the field coils.
The next tricky area is replacing the bushing on the back of the generator housing. This is the bushing that the armature shaft bearing rides in. If it looks good go ahead and reuse. If worn, take the housing to a generator shop to have the bushing replaced. Check the front armature ball bearing, if these need replacing you can have this done at a generator shop as well. If the armature was not dragging on the field coil segments then chances are the bearing are still good. Clean them up and when assembling use as small amount of white grease on the rear bearing. Replace the graphite brushes and reassemble the generator rear housing.

You will need to hold the brushes back carefully while installing the rear housing, be careful not to get any grease or oil in the area where the brushes ride on the armature. Your generator is now ready to go.

here are parts for the conversion:
http://vintageautogarage.com/g12vk-cae.html

A word of caution, don't change the front pulley size (diameter) on the generator to try and make it run faster at idle. Here is what will happen if you do; you will over REV the generator at freeway speeds and will damage the generator. A generator turning too fast will actually overheat the generator and will cause the solder to melt. Then your generator will be toast!
This was refereed in the old days as throwing the solder. If you don't want to tackle any of the generator conversion, you can take it to a generator shop and have them convert and overhaul for you. If the shop does not have field coils, we can supply these.

http://vintageautogarage.com/g12vk-cae.html

Replacing the ignition coil. There are 2 types of ignition coils, one with internal ballast resistors and one with external. Chances are you have a coil with external resistor. Here is why a ballast resistor is used in all ignition systems in the first place. These resistors are used to supplement the ignition coil's primary resistance. Also known as "points savers," ballast resistors have been used for decades to reduce current to the ignition coil and points, extending their lives.
The least expensive coil is external resistance coil and works just fine and keeps vehicle original. or you can install internal resisted coils, just make sure you find and remove the original resistor. It is a white looking small block with wires on each side.

http://vintageautogarage.com/coils.html

Special note: points and condensers will work on 6 or 12 volts no need to change provided they are good. Note: a shorted condenser will keep your engine from starting or will shut down. Always keep a spare in the glove box in case you get stuck somewhere with this problem.

For the Ford guys with the old type distributor with the coil installed on the top of distributor you will need to convert and allow for external coil mount. You should mount your new coil in close proximity to the distributor but away from contact with radiator hose or other direct heat. here is link to see these items.

http://vintageautogarage.com/02415eca-fag.html
http://vintageautogarage.com/02415lca-fag.html

Remember when changing polarity your coil negative will go to the distributor points. If you don't reverse the terminals your coil will still work, it just will not give you the maximum spark to the plugs. Next install the new 12 volt voltage regulator. Leave the field wire loose, as I will tell you what to do latter on this to energize the generator field coils.

You are now ready to tackle the conversion of the Oil, Gas and Temp gauges. Remember the gauges were meant to work on 6 volts. If you apply 12 volts to them they will burn up! I recommend the use of a solid state voltage regulator versus any type of resistor as these work the best and protect your gauges. Here is another good reason to convert from positive to negative ground, most all solid state device including gauge voltage regulators only work on a negative ground system.

Remove the gauge cluster and install the voltage regulator in series with the battery or hot lead. Each vehicle is different, refer to your repair manual for specifics. Remember rule of thumb, in all negative grounded systems the sending unit goes direct to the grounded (-)side of the gauge and the gauge
reducer goes on the positive side + of gauge.

When using the VREG reducer there is no need to change the 6 volt sending units as the VREG is designed work with original 6v sending units. This means no need to change out your 6 volt oil, gas, temp sending units.

http://vintageautogarage.com/voltage-regulator-12-volts-to-6-volts-to-6-volts-to-6-volts-to-6-volts.html

Heater blower motors- if your motor is 6 volts will need a voltage reducer
or you can rewind your blower motor to 12 volts, or go to the wrecking yard and find a 12 volt motor that will fit your heater.
click this link for dropping resistor for heater blower motors.

http://vintageautogarage.com/heater-motor-dropping-resistor.html

Radio's that are post war there should be no problem with conversion and your 6 volt radio. The radio uses a vibrator to turn DC to AC and the vibrator does not care about polarity of your car electric system. (except read below) The tube heater elements do not care which way the electricity comes into the radio either, as they operate just like a light bulb. The rest of the radio operates on the electricity that comes out of the vibrator and the transformer.

http://vintageautogarage.com/radio-heater.html

On most all pre-war radios they use a synchronous vibrator, these may not work when you change the polarity of your electrical system.
Best to check with a qualified radio shop for assistance:

The voltage to your radio does matter as 12V will toast a 6V radio, Tube heaters are designed for 6.3V +/- 10% and not 12 volts.


You will need to replace all the light bulbs, start from the front to the rear If you need bulbs here is a kit:


Install your new 12 volt battery. I would recommend that you replace the battery cables and extend the ground cable to a bolt on the started motor or direct to the engine, originals are connected
to the frame. Good grounds are really important! Recommend using 1/0 cables with shrink wrapped ends.

http://vintageautogarage.com/cablekit612-cae.html

You will need to POLARIZE your generator after conversion. (No need if installing an alternator). (most fords use a B circuit) and (most GM cars use an A circuit). This is for a B circuit. Disconnect the field wire from the regulator and strike it to the battery terminal of the regulator until you see a spark. Do not try to use a jumper wire for this, you need to actually remove the wire to do this correctly. Once you see a spark, reconnect the field wire to the regulator and you have completed this step.

Now check the voltage coming from your generator, connect a volt meter to the regulator, Battery connection and Ground connection or engine, low RPM will read around 12 volts, at higher engine speeds will reach 15 volts and the regulator will kick in, this is the voltage required to charge the battery. and is also why your old 6 volt lights will burn out in a hurry!

Parts List (these are approximate prices)

1 amp output regulator powers Oil, Temp, Gas gauges $60
1 set 12 volt Generator Field Coils and brushed regulator kit $150
1 12 volt ignition coil with ballast resistor $40.00
1 Headlight Relay (optional) $35.00
1 12 volt battery $59.00 to $89.00
1 radio dropping resistor $50
1 Heater blower motor dropping resistor $22.
Set of all bulbs price will depend on what you need $40-$50
6v to 12v alternator conversion kits will run around $350-$500 depending on your vehicle needs.

http://vintageautogarage.com/convertkits.html

You should always install a headlight relay and here is why: Pre 1960’s vehicles routed all the voltage through the dash switches as there were no electric relays. This caused dim lights because the switch contacts get dirty and burned. Installing a relay will solve this problem.
Here is link to see headlight relay kit:
http://vintageautogarage.com/relayheadlight.html

Also change our the horn relay and start solenoid if you have one:
http://vintageautogarage.com/hr106t-cae.html
http://vintageautogarage.com/relays.html

If you have a Borg Warner Overdrive installed in your vehicle there is no way you can put any type of reducer on the solenoid or relay to make these work. These items need to be replaced with 12 volt units.

Here is link to more information on BW OD solenoids and relays.
http://vintageautogarage.com/overdrive.html

If you want a great book on BW OD how they work and troubleshooting guide here is a link to the best darn book on the markets.

If you want to eliminate the points and condenser in your distributor you can install electronic ignition. Will give your engine better performance and you never need to replace points or condensers again which eliminates an area of trouble. If your condenser ever internally shorts your engine will stop and you will never get it started.

here is a link to see various ignition systems:

Special General Note: Make sure all your grounds are tight, this is the most common electrical problem in all older vehicles.

Converting to 12 volts is not difficult and gives you a enjoyable and reliable vehicle.

Have fun and be safe!

Len
http://vintageautogarage.com