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????????????????(Transient Voltage Suppression diode)????TVS????????PCB????????????  
??TVS??TVS????5V????12V???

[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/HDA1.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/HDA1.jpg)[/img]

????????????PCB????????????HDA??HDA??  
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????????????????????

[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/lid.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/lid.jpg)[/img]

????????????????????????????  
????????????????HDA?

[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/HDA.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/HDA.jpg)[/img]

Precious information stored on platters, you can see top platter on the picture. Platters made of polished aluminum or glass and covered with several layers of different compounds including ferromagnetic layer which actually stores all the data. As you can see part of the platter covered with the Dumper. Dumpers sometimes called as Separators located between platters, they reduce air fluctuations and acoustic noise. Usually dumpers made of aluminum or plastic. Aluminum dumpers better for cooling air inside HDA.

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????????????????????????????????Separators located between platters????????????????????????????????  
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Next picture shows platters and dumpers from the side

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[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/platters.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/platters.jpg)[/img]

Heads mounted on Head Stack Assembly or HSA. This drive has parking area closer to the spindle and if power is not applied on a drive, HSA normally parked like on the picture.

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[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/parking.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/parking.jpg)[/img]

HDD is a precision mechanism and in order to work it requires very clean air inside. During work HDD may create some very small particles of metal and oil inside. To clean air immediately a drive uses Recirculation filter. This hi-tech filter permanently collects and absorbs even finest particles. The filter located on the way of air motion created by platters rotation.

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????????????????????????????(Recirculation filter)??  
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[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/filter.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/filter.jpg)[/img]

Now we are going to remove top magnet to see what is under.

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[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/magnet.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/magnet.jpg)[/img]

HDDs use very strong Neodymium magnets. Such a magnet is so strong it could lift up to 1300 times its own weight, so don't put your fingers between magnet and steel or another magnet - it can develop great impact. You can see on this picture there is a HSA stopper on the magnet. HSA stoppers limit HSA movements, so heads wouldn't bang on the platters clamp and on the other side they wouldn't just fly off the platters. HSA stoppers may have different construction but there are always two of them and they always present on modern HDDs. On this drive the second HSA stopper located on HDA under the top magnet.

??1300??

????????????????(HSA Stopper)????????????????????????????

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?????(HSA Stopper)????????????????????????????

????????????????HDA????????

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[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/voice-coil1.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/voice-coil1.jpg)[/img]

There is the other HSA stopper. And you also can the second magnet. The Voice coil is a part of HSA, Voice coil and the magnets form Voice Coil Motor or VCM. VCM and HSA form the Actuator - a device which moves the heads. Tricky black plastic thingy called Actuator latch is a protection device - it will release HSA when drive un-parking (loading) heads normally and it should block HSA movements in the moment of impact if drive was dropped. Basically it protects (should, at least) heads from unwanted movements when HSA is in parking area.

??(VCM)?VCM?HSA????????????????????????????

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On the next step we going to take out HSA

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[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/HSA.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/HSA.jpg)[/img]

HSA has precision bearing to make movements nice and smooth. The biggest part of HSA milled from piece of aluminum called the Arm. Heads Gimbal Assembly or HGA attached to the Arm. HGAs and Arms usually produced on different factories. Flexible orange widget called Flexible Printed Circuit or FPC joins HSA and plate with heads contacts.

??(Heads Gimbal Assembly)???HGA????????????HGA????  
????????????????  
????????????????????FPC?FPC????????????????????????????

Let's take closer look on each part of HSA.

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Voice coil connected to FPC

?????FPC



Here is the bearing

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On the next picture you can see HSA contacts

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The gasket makes connection airtight. The only way for air to go inside HDA is through the breathing hole. On this drive contacts covered with thin layer of gold, for better conductivity.

??HDA??



This is the classic definition of the arm. Sometimes by the arm imply the whole metal piece of HSA.

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The black small things at the end of HGAs called Sliders. In many sources you can find that sliders claimed as actual heads but a slider itself is not a head it's a wing which helps read and write elements fly under the platter's surface. Heads flying height on modern HDDs is about 5-10 nanometers. For example: an average human's hair is about 25000 nanometers in diameter. If any particle goes under the slider it could immediately overheat (because of friction) the heads and kill them that's why clean air inside HDA is so important. The actual read and write elements located at the end of the slider and they are so small that can only be seen under a good microscope.

HGA??  
????????????????????5-10????????????????????????????25000??  
??HDA????????????????  
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As you can see slider's surface is not flat, it has aerodynamical grooves. These grooves help a slider fly on the certain height. Air under the slider forms Air Bearing Surface or ABS. ABS makes slider fly almost parallel to the platter's surface.

??(Air Bearing Surface)??ABS?  
ABS????????????????????????

Here is another picture of the slider

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[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/heads2.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/heads2.jpg)[/img]

You can clearly see heads contacts.

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There is very important part of HSA which we haven't discussed yet. It called the preamplifier or preamp. The preamp is a chip, which controls heads and amplifies signals from/to them.

????????????????????????????????????(preamplifier)???preamp????????????????????????????????

[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/preamp.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/preamp.jpg)[/img]

The reason why the preamp located inside HDA is simple - signals from heads are very weak and on modern HDDs have more than 1GHz frequency, if take the preamp out of HDA such weak signals wouldn't survive, they will disappear on the way to PCB.

????????HDA????PCB??1GHz????????????????PCB????????????????????????????????  
????????????

The preamp has much more tracks going to the heads (right side) than to the HDA (left side), it's because HDD can work only with one "head" (pair of read and write elements) at a time. HDD sends control signals to the preamp and the preamp selects the head which HDD needs at the current moment. This HDD has six contacts per "head", why so many? One contact is for ground, other two for read and write elements. Other two for microactuators - special piezoelectric or magnetic devices which can move or rotate slider, it helps tune up heads position under a track. And finally the last contact is for a heater. The heater can help adjust heads flying height. The heater can heat the gimbal - special joint which connects slider to HGA, the gimbal made from two stripes of different alloys with different thermal expansion. Once gimbal got heated it bents itself toward platter's surface and this action reduces flying height. After cooling down the gimbal straights itself.

????????????????????????HDA????????????????????????????????????(????????)??  
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????????????????????????????????????for ground????????????????????????????????????(????????????????????????????????)????????????????  
??(????????????????HGA????????????????????????????????)????????????????

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Enough about heads, let's continue disassembling. We going to remove top dumper.

????????????????????top dumper?

That's how it looks

top dumper????

[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/dumper.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/dumper.jpg)[/img]

And next picture shows HDA without the top dumper and HSA

????HDA??HSA?top dumper?

[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/HDA2.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/HDA2.jpg)[/img]

Now the top platter is not covered, you also can see the bottom magnet

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Let's move further and remove the platters clamp

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[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/clamp.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/clamp.jpg)[/img]

The platters clamp squeezing platters into the platters packet, so they wouldn't move.

Platters sitting on the spindle hub, the platters clamp creates enough friction to hold platters on the hub when spindle rotates.

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[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/HDA3.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/HDA3.jpg)[/img]

Now when nothing holding platters on the hub we are going to remove the top platter and next picture shows what we may see under.

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[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/HDA4.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/HDA4.jpg)[/img]

Now you see how platters packet has room for heads - platters laying on spacer rings. You can see the second platter and the second dumper.

??dumper?

The spacer ring is a precision detail made of non-magnetic alloy or polymer. Let's take it out.

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[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/ring.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/ring.jpg)[/img]

Finally we are going to shake out the rest of the stuff from HDA and see the base

???????HDA????????????????????????

[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/HDA5.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/HDA5.jpg)[/img]

That's how the breath filter looks. And the breath hole located right under the breath filter. Let's see the breath filter closer.

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[img][http://en.rlab.ru/doc/images/hdd\\_main\\_parts/breath-filter.jpg](http://en.rlab.ru/doc/images/hdd_main_parts/breath-filter.jpg)[/img]

Because air from outside definitely has dust the breath filter has several layers of filtration and it's much thicker than recirculation filter, it also may have some silica gel inside to reduce air moisture.

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