# Team 1-Rover Ova

For movement -rocker mechanism,can cross 30 cm obstacles, wheels have hub motors, travel upto 45 \* slope, wheels have independent steering,

For delivering objects-(basket for keeping things )- and end effector for lifting things upto 5 kg

For power – 2 lithium polymer batteries(4s and 6s)- 2hr battery capacity

For navigation-zed2 camera , independent gps system and doesn’t need operator

The manipulator- has 6 degree ofmotion- uses spur , worm , cycloidal gearbox

For communication- uses wifi system- antennas provide communication upto 1 km,- rc transmitter-

Laboratory module-scooping end effector to collect soil samples- uses hopper mechanism to load soil

# Team 2 – ITU rover team

Chassis is made of aluminium which makes it durable

To travel uses rocker suspension system- brushless dc motors are used so that provide greater speed than traditional motors

Steering system – each wheel rotates independently – pid controlled bldc motors

Power-lithium ion battery (24V)

Communication – 2.4 Ghz wifi system, and a directional antenna

Cameras-usb and fpv cameras

Good interface of simulator of the competition

Grippers use 6 degree movement system- robotic arm is very precise

Very less time taken to get ready for missions due to single cable line system

Can take sample 3 times so test performed are more accurate

Biosensors used to detect glucose-raman spectrometer to detect lipids(a strong indicator of life)

Ai is been used with microscope – atmoshpheric sensors are used such pressure humidity

OVERALL , the scientific aspect of rover is great and remarkable with great details mentioned.

# Team 3 –Yildiz Rover

Chassis- light weight aluminium-rocker suspension system made of tough carbon fibre

Movement – 45 \* climbs

Uses brushed dc motors so less efficient

Power – lithium ion battery

Communication- upto 2 kms -5.8 Ghz

Between electronic devices by CAN protocol(controller area network)

Steering system- motors controlled with pid-

Cameras- zed2 cameras to detect- reover needs to get closer so not a good detection system

Sensors-imr, lidar, rtk gnns, wheel encoders for navigating rover

Gripper- 6\* freedom ,uses linear actuator , stepper motor and magnetic encoders- can lift 5 kg

Collection of samples with a spoon not that accurate

Research- good database of rock colours and sample to identify it .and has all the required sensors

Good for research but slow in mobility and tasks such as picking, great communication technologies

# Rover 4 –titan

Movement – rocker bogie system – greater incline of 60 degree-non mneumatic tires

Gripper system-less freedom in movements and slower mechanism

Hydrogen peroxide test for protein(for presence of life)

Raman spectrometer test( to look for amino acids)

2.4 Ghz communication system- uses open cv technology in cameras which if an advantage

# Rover 5 – ADASTRA

Chassis – has good stability- has rocker bogey system

[TPU (Thermoplastic polyurethane)](https://www.bing.com/ck/a?!&&p=ef9df12863e94ce5JmltdHM9MTcwNjU3MjgwMCZpZ3VpZD0zNmM2ODNhZC1jYTY3LTZlM2ItM2Y4NC05M2VlY2JkNTZmNjMmaW5zaWQ9NTIyNQ&ptn=3&ver=2&hsh=3&fclid=36c683ad-ca67-6e3b-3f84-93eecbd56f63&psq=tpu+wheels+fullform&u=a1aHR0cHM6Ly93d3cuc3dlZGV3aGVlbC5jb20vZW4vcHJvZHVjdHMvd2hlZWwvd2hlZWwvdHB1LSh0aGVybW9wbGFzdGljLXBvbHl1cmV0aGFuZSk&ntb=1) wheels – advantage widthstand high temperature

Electronics-pcb and transmitters

Gripper- stm32 (stress control motion)

Research-computer vision to determine amines, ph level of soils whether life can exist, chrystal structure to indicate change in environment

3D point cloud with gps is impressive

Interactive display on rover –

Has redundant system in case there is problem in rover, integrating machine learning and creating heat maps

# Team 6 Anveshak

Movement-It doesn't look like it has good rigidity and moment of inertia. Simply put it is limping. Aluminium plate at the arm looks heavy

For movement -rocker mechanism, can cross obstacles

Robotic arm- 5\* of freedom lesser than the others-use of worm gears

For maintenance task-parallel 4 bar system to grip – lift upto 6 kg, does maintenance task very well

Communication 2.4 Ghz

Research – has all onboard sensors, great database of rocks and soil-uses a depth camera

Overall –okay robot , wheels move in uni direction and mobility not that great .

# Team 8 ROBOCOL

Movement-Uses ony 4 wheel – not good for movement

Functional pulley system used

Raspberry pi4 electronic system

Lithium polymer batteries

Gripper system – taking too long time and not accurate

Cameras – uses 4 camera- a real sense camera

Average research tech used

# Team 9 REXUS

Chassis – aluminium rod chassis can move upto 25 \* only – would not be able to cross terrains and inclines

Only 4 wheels – rigid movement system

Robotic arm – 4\* of motion uses stepper motors

Thus less scope of movement of robotic arm

Maintenance task needs gripper which is still nod made

Temperature, humidity . and other environment sensors are there

No good research to find whether life exist

# Team 10 Mavrik

Good grippers for maintenance tasks- can lift every substance on mars

Movement -6 wheels , working independently

Uses GPS systems and cameras for navigation , self correcting technique is commendable

Research – protein detection for life

Model doesn’t look robust , windy conditions can inflict a damage

# Team 11 - VIT

Movement – 5 \* freedom, parallel arm grippers, ln key to perform screw driver tasks

4 wheel differential drive system

Electrical-uses backup power circuits, and has emergency system- has sectoral and omni directional antennas

Camera- real sense cameras and encoders

Research-test for nucleic acid , protein , carbs-for life-raman spectrometer for other chemicals

Could be better in movement but great in scientific and other purpose

# Team 12 –TMR

Wheels consist of petg rims and polyurethane tyres , great for movement

Maintenance tasks- gripper with 5\* arm , was doing all the tasks

Communication – 2.4 Ghz frequency

Cameras – tailored search pattern and open cv tech to detect ar tags

Power-Lithium ion battery

Research – ion test and lipid test , proper database for rocks with depth camera

Overall great robot covering all aspects

# Team 13 CALTECH

Wheels- 24 cm inflatable balloon wheels

Can cross obstacles upto twice of wheels diameter

Robotic arm- 6\* freedom , clock ripper to operate switches ( using worm gear)- continuous roattion joint an linear actuator for screw purpose

For calculation –inverse kinematics is used

Communication – remarkable with Bluetooth and rs 45 –ross 2 system upto 2.4 Ghz

Cameras – lidar and zed cameras

Research – test for carbs and proteins – espi microcontroller for rocks and cv tech.

Covers all the aspect required

# Team 14 Deimos

Chassis - Aluminium chassis- rocker bogey system

Movement -45 \* incline- balloon wheels – can cross obstacles double the size of wheels- diff

Robotic arm – 6\*freedom ( 2 actuators and encoder)

Electronics – Arduino nano and nvidia dats- raspberry Pi and stm 32 boards

Communication – rocket ac light system 5.8 GHz- omnidirectional antenna and sector antenna – each motor works independently with pcbs

Electronics – voltage and current sensor , easy graphic user interface between rover and control system

# Team 15 – Mars rover design team

Chassis- lightweight- carbon Kevlar wheels – can widthstand 1 m vertical drop so good suspension system

Movement – 45 \*

Communication

Cameras -8 required , z2i camera, 2 18- \* camera

Power-Lithium ion battery with current sensors and

Robotic arm – 6 \* arm- h motors and brush dc motors(makes it inefficient)

Can do all the maintenance task

Navigation – differential gps system

Cv algorithm to detect ar tags

Research – gas sensors for nitrogen, 400x magnification microscope, spectroscopy and electroplating

Great rover but doesn’t have backup system

# Team 16-lehigh

Chassis-rocker bogey system / aluminium and carbon tyres)wheels not that great rigid in movement, not move independently

Robotic arm-6\* freedom, grippers can do all the operations like screwing – inverse kinematics for control

Research – database present but no microscopes

Electronics – 4 stepper motors , servomotors / 2 rasberri pi , connection through rocket m2 system

Will take times to perform task due to weakness in movement and wheels

# Team 17 – mongol barota

Chassis-stainless steel / 4 wheel system

Robotic arm-5\* freedom , can do all maintenance task

Power- lithium polodium batteries

Backup system present

For movement –cv and odometry technology

Camera- 2d pose estimation and multimarker detection for ar tags

Communication – 2.4 and 5 Ghz

Research-3 actuators to take soil samples

Protein – biuret test carbs bennedicts test and ammonia test for life presence

# Team 18 Trickfire

Electrical – 3 36 v battery , nvidia tech , can controller

Communication 5 Ghz wifi with 2 antennas

Wheels –tpu thermoplastic tyres

Gripper – 2 servo motors( 2 finger and 4 finger)- will not be able to do screwing tasks

Chassis- wheels doesn’t move independently

Not good in mechanical part

Quadcopter drone

# Team 20 sooner

Electronics microcontroller for the arm , pid for arm functions and inversekinematics for gps

Can do all the maintenance tasks

Wheels – marzocard design (unique feature)

Research- no data mentioned in video

Pid system for movement

# Team 21 quantum robotics

Chassis/wheels-Differential suspension rocker bogey drive/ tpu wheels

Electronics – pcbs

Navigation – immune sensors and gps , uses prims algorithm to reduce time

Robotic arm – 5\* robotic arm( forward and inverse kinematics)

Research-test of protein lipid saccarides carbohydrates

Great rover , will perform well in urc as covers all aspects

# Team 22 Monash

Chassis/wheeks-rocker suspension system with pivot steering, 49 nm torque ( can rotate very quickly)

Electronics- Ubuntu 20 and ros 2 foxy, bldc motors

Communication -

Power – lipo batteries

Arm – inverse kinematics , 6\* freedom,collision detection system , can not lift big objects

Research – proteins and atp lipids , raman spectrometer,

Autonomous system - 2 stereoo cameras , ar tags detection system( 10 m)

Motion is rusty over rough terrains

# Team 23 Manipal

Chassis- aluminium body , middle wheels could be lifted in case of obstacles, great speed

Robotic arm – lead screw gripper end effector, 6\* inverse kinematics

Electronics-2 modes for arms(drive and reach mode), motor controlled by pid algorithm, can do maintenance tasks, esp 32 micro controller, jetson annex and rasberri pi

Has emergency backup system –

Research-screw bases auver ( cannot lift much sand), fluoromarkers for niomarker detection, protein , labile carbon , environment sensors

Camera z2 stereo

Not great detection technique or else good

# Team 24 sar

Chassis – wheels / not of great strength made of sunboard, moves only linearly

Arm – only 2 \* motion

Not according to urc levels

# Team 25 UCL

Chassis / wheels – wheels doesn’t move independently, chassis not covered completely

Research – measures acidity , humidity and temperatre – spectrometer present- b-ceentriutd oesnot check protein for life presence

Arm –pid controller , inverse kinematics system , movement with joystick (not autonomous)

Navigation – global map and zed cameras with fused maps

Remarkable navigation techniques but in research domain

# Team 26 –WEMARS

Chassis/ wheels – Apollo chassis- rocker bogey mechanism, rubber wheels ( not that tough)

Electronics – esp 32 microcontroller/ rasberri pi

Power – lipo battery 4

Camera – esp32 cameras

Navigation – pubnub live location ( realtime)

Not mentioned about research **( 1 main task)**

# Team 28 RUDRA

Chassis/wheels-spring suspension mechanism – 4 wheel drive –independent height system

Arm – 5\* freedom –

Science mission – auger mechanism – centrifugation –detects gases like ammonia, Co2 ,H2S,

Electronics-nvidia tx2 and jetson nano – 6 lipo battery and kill switch sysrem –

Software-microcontroller and gpu’s

The active suspension is really cool!

Average rover 9 due to less research facilities for life)

# Team 29 Telos

Wheels – honeycomb structure( increases durability ) – rocker bogey mechanism- wheels move independently

Robotic arm – able to lift big and minute objects,

Cameras- aruko marker detection ( 20 m)

Software – semantic segmentation and deep learning algorithm

Electronics – a kill switch, gpu

Battery – work for 2 hours

Communication- directional and omni directional antenna

Research – amino acid / carbs/lipid/chlorophyll- rock database and raman spectrometer

Great and remarkable rover covering all aspects of competition

# Team 30 Mongol tori

Wheels –rocker buggy mechanism, has an extender to change centre of mass to adapt to different situation

Arm – 6\* freedom

Communication – 5.8 Ghz system , omnidirectional antenna

Electronics – Saturn motor driver, kill switch

Gps – Jason nano / rdg gps, open cv library for ar tag detection / depth camera

Research – environmental sensors/ npk probe detector( nitrogen phosphate potassium)

Performs maintenance task using ai model and inverse kinematics

Great but movement could be better

# Team 31 aust(audio not clear)

# Team 32 Kratos

Chassis- t slot aluminium chassis, 6 wheel honeycomb pattern , differential drive pattern

Communication

Electronics- pid controller, power- Works only 90 minutes

Arm-5\* freedom- rover not moving sideways- doing all maintenance tasks

Spiral search algorithm for ar tags , embedded system,sensor interfacing,computer vision

Research – soil type texture database , all types of environment sensors

Overall great robot

# Team 33 SGSU

Wheels – 3 wheels with 120\*

Slow in speed

Does all maintenance tasks

Navigation-autonomous

Not competable in challenge

# Team 34 Interplanetar

Mechanical – rocker buggy mechanism , chassis – stainless steel arm tubes-

Arm – 6\* freedom worm gear –does all tasks with 360 \* rotation

Navigation – 9\* of freedom imu and gps model / jetson navier n- 3d point cloud data

Remarkable navigation data

Central and omnidirectional antenna

Research – scoopers for soil collection/ detection of protein lipid etc

Covers all base

# Team 36 UW

Mechanical – 6 wheel rocker bogey and differential bar , bldc motors ,

Research – co2 level temperature , sunction mechanism in take soil ,ninhydrin test for proteins,

Z2 stereo camera for depth

Communication – runs on 3 frequency fans/ 5 for videos , 2.4 for normal data , 900 Mhz for essential

# Team 37 iit Bombay

Mechanical – **7\*** of freedom mechanical arm( only rover above 6 \* ), rocker bogie design 6 wheel drive, 40 \* incline , skid steering

Does all maintenance tasks , slip ringmotor

Research – temperature humidity and methane sensors, ph protein and life presence , raman spectrometer

Electronics – intelnut processor, 12v lipo battery, dual band communication system

Navigation – lidar sensor , z2 stereo camera

For tags – open cv tech

Best rover till now , advanced tech in each field than others

# Team 39 – north easterm

Mechanical – aluminium –rocker buggy system ,

Arm -3 finger claw , 6\* freedom

Electronics- stm 32 microcontroller, custom camprotocol

Research – atp detector , rock database ( less research )

Communication – directional and omnidirectional antenna , zed2i stereocamera

Drone –wooden prototype quadcopter /

Lacks in research

# Team 40 - roverx

Mechanical – double rocker system / aluminium chassis, honeycomb wheels for shock absorbtion

Kill switch for safety

Arm – 6 \* freedom , worm gears , does maintenance tasks

Navigation-spiral search pattern for ar tags,

Power – lipo battery

Electronics –stm 32 software

Science – raman spectrometer for rocks , npk detector , soil ph , temp, microscope (all the science facilities)

Great rover , covers all basis

# Team 41 AGH

Mechanical – 4 wheel suspension independent drive , resists vibration

Arm – 6\* freedom , bldc motor ,

Kill switch mechanism

Not autonomous controlled arm

Navigation – imu and gps rtk , cv algorithms for aruco tags

Slow in drive systems

# Team 42 poly orbite

Mechanical – doublelayer damping tyres , 6 wheels , 35 \* incline ( lesser than required), rocker bogie suspension

Arm- - ^\* freedom , grpper – do maintenance

Science- not mentioned

Details not much in video

# Team 43 -ASTRA

Mechanical – aluminium chassis ,trapezoidal suspension , can climb vertical spaces,

Arm – 6\* freedom , 3 actuators and 3 servometer

Electronics- nvidia jetson

Research – 6 different soil samples ,

Best movement system till point

# Team 44 KNR

Mechanical – 6 wheel, robust model, bldc motor

Arm – 6\* arm c

Power – lipo battery/ kill switch mechanism

Research – carbonates with HCl

# Team 45legendary

Arm – 6\* , but **slow** in speed

Electronics – gnu linux system/ lidar sensor

Research- ph measurement , colour analysis, temperature

Less details mentioned which weren’t satisfactory

# Team 46 rose

Mechanical – petg and tpu wheels

Arm- 6\* freedom

Electric- nvidia jetson nano board, omnidirectional antenna

Power – 4 lipo batteries, 72 ahm output

Navigation – imu depth camera, tracking cameras

Tags – open cv,

Research- uv vis spectroscopy , amino acid , citrophin

Covers all aspect

# Team 47 Generosity

Electrical – pcb custom made, microcontroller, fuses

Arm – inverse kinematics

Research – led lit barrel for rock samples

Ece- 2 rasberry pi/flutter

# Team 48 wvu mountaineers

mechanical – bouble bogey system , slow in movement, 4 wheels

arm -4\* freedom, 2 bldc motors

ece- 900 Mhx radio,

research – 14 samples,

not competable

# team 49 ROSE

MECHANICAL-rocker bogey suspension , 5\* freedom arm, aluminium chassis, vice group end effector

Ece – kill switch, worm wheel

Research- rasberri pi camera, nucleic acid,proteins, minerals , inorganics,

Navigation- gate detection and aruco tag , app to control and receive data

Great

# Team 50 cornell

Software – computer vision

Arm – inverse kinematics with open cv, cycloidal and strain wave gearing, extend cam , end cam

Mechanical – 45\*incline

Electrical – pcbs, stm32 microcontroller , micro ross, current sensing for – tags

Research – spectroscopy, concentration of cells in soils, NPK detector , CaCo3,

Suspension not there in body

# Team 51 pharaohs

Rocker bogey suspension, airless tyres , honey comb tyres

Arm – linear actuators

Ece- 2 pcbs, Arduino(microcontroller)/ servomotors and actuators

Navigation – ros2 , odometry for path planning

Research – Geiger counter, sensors

# Team 54 wasshington

Mechanical- climbs vertical wall, gripper proper for lifting objects, worm gear

Research – signals for environmental sensors, auger to dig samples,spectrometr for colour readings proteins and life presence

Communication- antennas , open cv python scripts

Competeble team as covers aspects

# Team 55 ares

Not proper chassis , high winds will affect it

Ece – 26 v lithium ion battery , 5.8 Ghz

Kill switch

Research – proteins , lipids , carbohydrates, environment sensors( ph , methane , ammonia , moisture ,temperature, pressure)

Cnn model

Software , particle filtering algorithm

Mechanical part not upto mark

# Team 56 penn

Wheel – honeycomb pattern

Arm – vacuum gripper