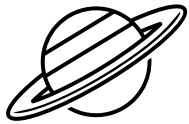


SPACE AGENCY



(Nasa inspired)

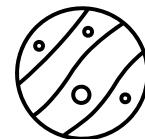


First: members' names:

- 1 _ Mohab Mamdouh kamle mosa (Computer Science).
- 2 _ Youssef Wael Mostafa (Computer Science).
- 3 _ Karim Mamdouh Abd al Qader (Computer Science).
- 4 _ Ziad Mohammed Gomaa Youssef (Computer Science).
- 5 _ Omar diaa Eldeen Mahfouz (Pure math & computer).

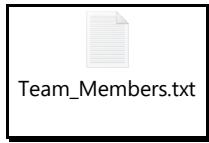
Second: supervisor name:

- * _ professor/Wael Zakaria.



//File contents(double click to open):

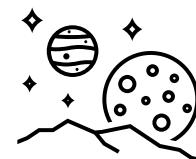
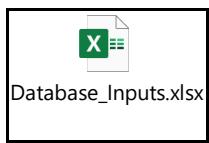
1_team members name.txt.



5_relational model.pdf.



2_data inputs. Excel.



6_creation_SQL file.



3_project_presentation.



7_SQL queries file.



4_EER.pdf.



8_SQL model.mwb.



Third: DESCRIPTION OF PROBLEM:

The Space Operations Mission Directorate: is a crucial part of NASA's operations. This directorate is responsible for maintaining a continuous human presence in space, which benefits people on Earth in numerous ways, from advancing scientific knowledge to developing new technologies.

The programs within this directorate are at the heart of NASA's human space exploration efforts. They enable various missions, including Artemis, commercial space initiatives, scientific research, and other agency missions. 

The directorate provides a range of services to support these missions. These include communication services, which ensure that data and information can be transmitted between Earth and spacecraft; launch services, which are responsible for getting spacecraft into space; and research capabilities, which allow NASA to conduct experiments and gather data in space.

In essence, the Space Operations Mission Directorate plays a vital role in making space exploration possible and advancing our understanding of the universe. It's a testament to the incredible work that NASA does every day. 

REQUIREMENT COLLECTION:

The agency needs to be aware of the specific details of space operations directorate for effective management and coordination:

1. staff(astronaut, scientist, inspector.....etc):

citizen identification number, fname, mname ,lname,{home address}: building no., street name, postal code, city, state, country, phone number {up to 3 numbers}, salary, birth date(age).

-astronaut:

education, experience, physical fitness (up to 10).

*-experience is the total years of working of the astronaut even outside of the current job.

-scientist:

specialty.

***-side detail:**

age is needed to be calculated.

2. crew details:

(Crew ID, name, status, start date).

***-side detail:**

Experience years is needed to be calculated.

3. partners:(organization code, organization name, address, email address, phone number).

4. space craft:

(spacecraftID, name, type/class{rover, space probe, crewedspacecraft, auto}, launchpad, status{active, lost, retired}, Power Source(solar, nuclear), dimensions {size and weight}, people capacity, load capacity).

5. planet: PlanetID (primary key), Planet Name, Type (terrestrial or gas giant), Diameter, Mass, Orbit Radius, Orbit Period, Rotation Period, Number of Moons, and Has Rings.

6. material: MaterialID (primary key), Material Name, Hardness, Brittleness, Flexibility, Impermeability, Transparency, Thermal Conductivity, and Heat Conduction.

7. mission: MissionID (primary key), Mission Name, Mission Type (e.g., Airborne Science, Analog Field Testing, Asteroid Deflection, Atmospheric Probe, Balloon, Commercial Crew, Commercial Resupply), Status (e.g., active, future, past), and objective.

8. research: research ID, name, type{e.g., Aeronautics, Space Environmental Effects, Renewable Energy and Building Energy Efficiency, Material Response Properties}, findings, publications no.

9.equipment (satellites, telescopes.....etc.):
ID, name, Status:(e.g., active, decommissioned). ,
type, origin country

9_1. satellite(communication, analysis):
Orbit Type {(e.g., geostationary, polar, low
Earth)}, Purpose:{(e.g., Earth observation,
scientific research, GPS)} .
-analysis: sensor type and resolution.

9_2. telescope:
focal length, diameter.
-space-based:
Orbit.
-Earth-based:
Mount-type, location.

Type values of telescopes and mount type values:
*Mount type {e.g.: altazimuth, equatorial, for
earth-based telescopes} .

RULES:

1. planet contains at least one material or more and material can exist on several planets.
2. mission can target one planet, but it is not a must, and each planet might be explored with several missions.
3. research is around mission or other objectives and mission must have minimum one research as a result or more.
4. one spacecraft goes to several missions and at least one mission and can be crewed or not with tracking the launch date and end date.
5. the members of staff work in different fields including inspector, astronaut and scientist.
6. The crew is required to consist of a minimum of 4 astronauts and a maximum of 7 astronauts and every astronaut has to join only one crew.
7. A scientist, whether alone or in collaboration with others, could conduct research using a variety of equipment, although the use of equipments is not a necessity.
8. the agency has several equipment including satellite, telescopes.....etc.

9. telescopes must split to two different types:

- space based
- earth based

10. satellites also must split to two different types:

- communication type
- analysis type

11. The communication satellite must be monitored with a group consists of a minimum of 2 inspectors and a maximum of 5 inspectors and every group has to monitor only one satellite of that type.

12. each communication satellite can connect with up to 5 spacecrafts (or none), and every spacecraft must have connection with one satellite.

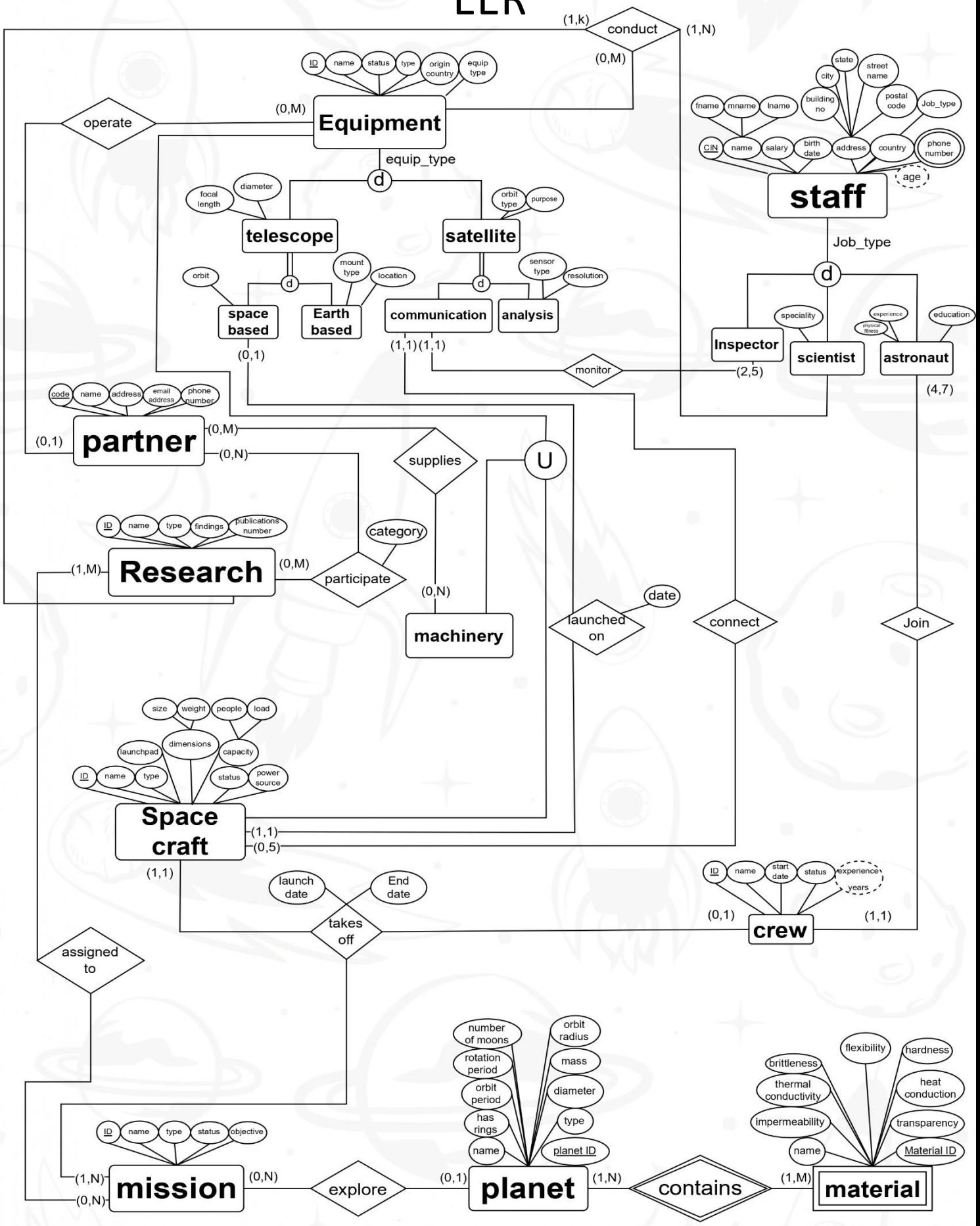
13. telescope must be launched on spacecraft if it is of space type and spacecraft can launch with one telescope.

14. equipment might be operated with one partner.

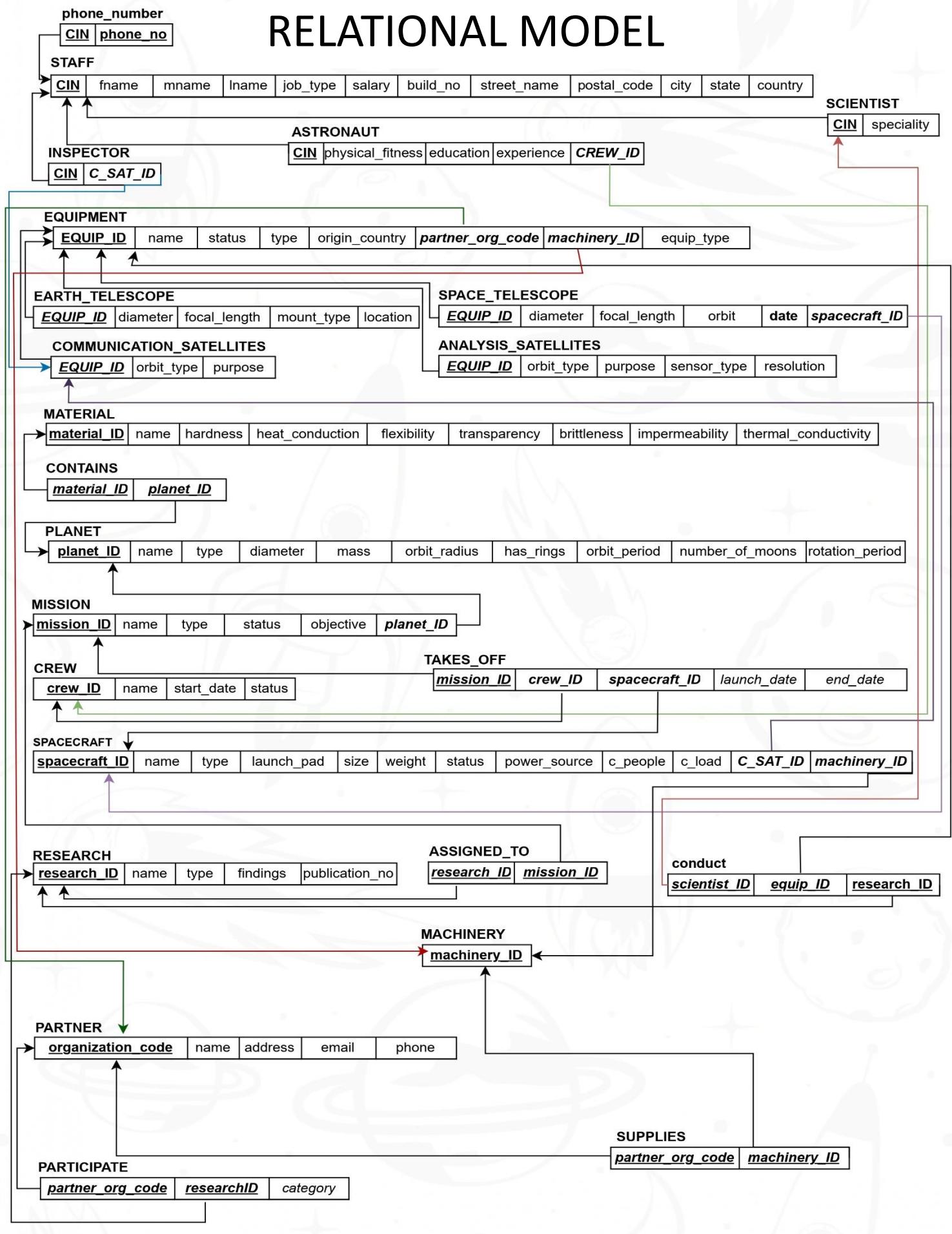
15. The partner may supply machines, which are equipment and spacecrafts.

16. some partners participate in research with different fields.

EER



RELATIONAL MODEL



RELATIONAL MODEL (2nd method) blue and italic for fk

PHONE_NUMBER : (CIN, phone number)

STAFF: (CIN, fname, mname, lname, job_type, salary, build_no, street name, postalcode, city, state, country).

INSPECTOR: (CIN, C_SAT_ID). | SCIENTIST: (CIN, speciality).

ASTRONAUT: (CIN, physical_fitness, education, experience, CREW_ID).

EQUIPMENT: (EQUIP_ID, name, status, type, origin_country, PARTNER_ORG_CODE, MACHINE_RY_ID
NN, equip_type)

EARTH_TELESCOPE: (EQUIP_ID, diameter, focal_length, mount_type, location)

SPACE_TELESCOPE: (EQUIP_ID, diameter, focal_length, orbit, date, SPACECRAFT_ID
NN)

COMMUNICATION_SATELLITE: (EQUIP_ID, orbit_type, purpose)

ANALYSIS_SATELLITE: (EQUIP_ID, orbit_type, purpose, sensor_type, resolution)

MATERIAL: (MATERIAL_ID, name, hardness, heat_conduction, flexibility, transparency, brittleness, impermeability, thermal_conductivity).

CONTAINS: (MATERIAL_ID
NN, PLANET_ID
NN)

PLANET: (PLANET_ID, name, type, diameter, mass, orbit_radius, has_rings, orbit_period, number_of_moons, rotation_period).

MISSION: (MISSION_ID, name, type, status, objective, PLANET_ID)

CREW: (CREW_ID, name, start_date, status).

TAKES_OFF: (MISSION_ID
NN, CREW_ID, SPACECRAFT_ID
NN, launch_date, end_date)

SPACECRAFT: (SPACECRAFT_ID, name, type, launch_pad, size, weight, status, power_source, c_people, c_load, C_SAT_ID
NN, MACHINERY_ID
NN).

RESEARCH: (RESEARCH_ID, name, type, findings, publications_no)

ASSIGNED_TO: (RESEARCH_ID
NN, MISSION_ID
NN)

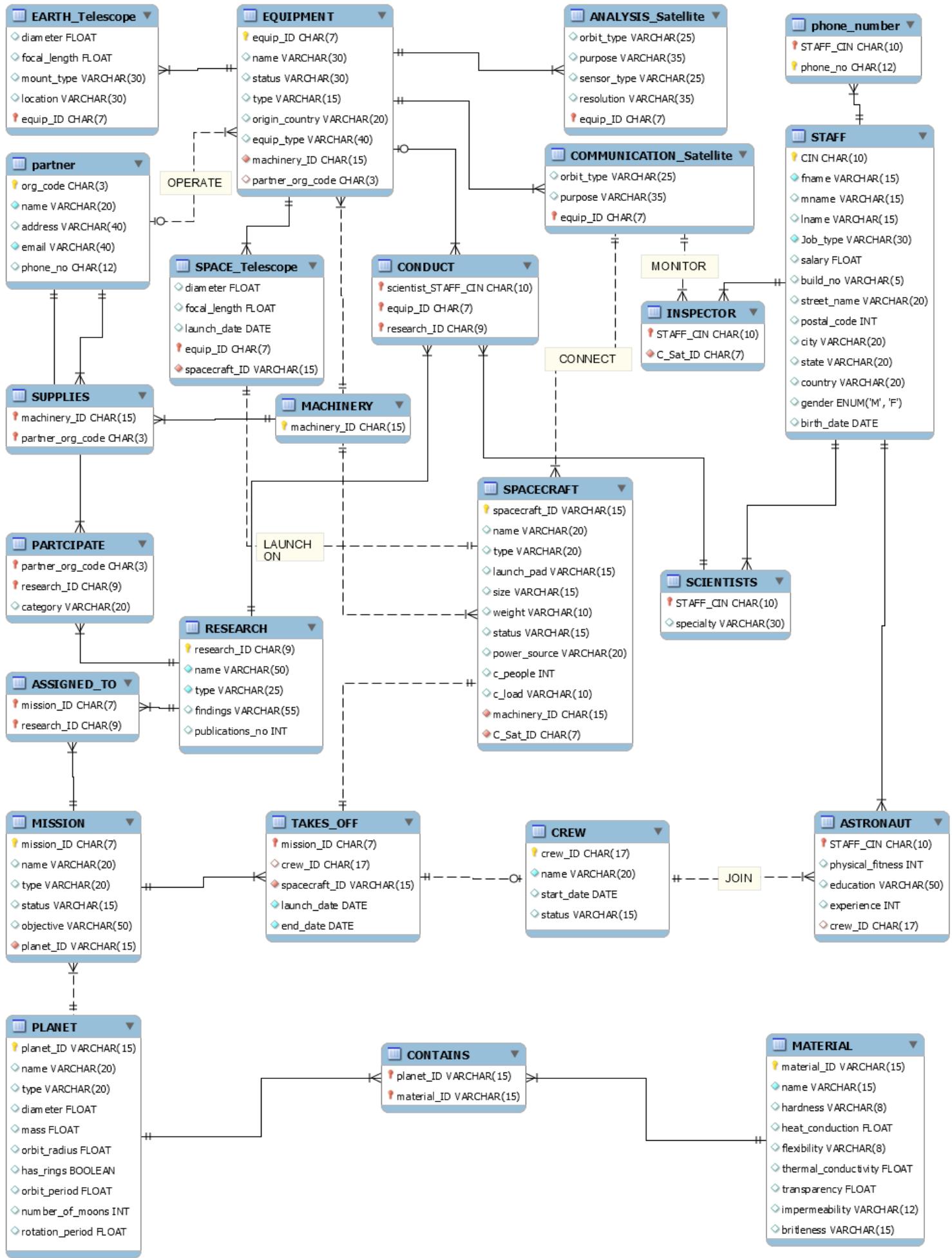
CONDUCT: (SCIENTIST_ID
NN, EQUIP_ID, RESEARCH_ID
NN)

MACHINERY: (MACHINERY_ID)

PARTNER: (ORGANIZATION_CODE, name, address, email, phone)

SUPPLIES: (PARTNER_ORG_CODE
NN, MACHINERY_ID
NN)

PARTICIPATE: (PARTNER_ORG_CODE
NN, RESEARCH_ID
NN, category)



SQL_QUERIES

```
1 -- 1-list telescope types and id
2 • SELECT equip_ID, type AS 'telescope type'
3   FROM equipment
4 WHERE equip_type = 'telescope'
5 ORDER BY type;
6
7 -- 2-list mexican equipment
8 • SELECT equip_id, name, equip_type
9   FROM equipment
10 WHERE origin_country = 'Mexico';
11
12 -- 3-list active missions details
13 • SELECT *
14   FROM mission
15 WHERE status = 'active';
16
17 -- 4-retrieve the available types of hardness in material
18 • SELECT DISTINCT hardness
19   FROM material;
20
21 -- 5-calculate the experience of each crew
22 • SELECT c.name,
23       DATEDIFF(CURDATE(), c.start_date) / 365 AS Experience
24   FROM crew c;
25
26 -- 6-list each equipment with its operator
27 • SELECT p.name AS 'operator partner', e.name AS 'operated equipment'
28   FROM partner p,
29        equipment e
30 WHERE e.partner_org_code = p.org_code;
31
32 -- 7-retrieve each partner and supplied machines including equipment and spacecraft
33 • SELECT p.name AS 'supplier', e.name AS 'machines'
34   FROM
35     partner p,
36     supplies s,
37     equipment e
38 WHERE s.partner_org_code = p.org_code
39     AND e.machinery_id = s.machinery_id
40 UNION
41 SELECT p.name, sc.name
42   FROM
43     partner p,
44     supplies s,
45     spacecraft sc
46 WHERE s.partner_org_code = p.org_code
47     AND sc.machinery_id = s.machinery_id;
48
49 -- 8-list crew name with their missions' name
50 • SELECT
51       c.name AS 'crew name',
52       c.status AS 'status',
53       m.name AS 'mission name'
54   FROM
55     crew c,
56     mission m,
57     takes_off t
58 WHERE t.crew_ID = c.crew_ID
59     AND t.mission_ID = m.mission_ID;
60
61 -- 9-retrieve each planet with its materials ordered ascendingly
62 • SELECT p.name AS 'planet', m.name AS 'material'
63   FROM
64     planet p,
65     contains c,
66     material m
67 WHERE p.planet_id = c.planet_id
68     AND c.material_id = m.material_id
69 ORDER BY p.name , m.name;
70
71 -- 10-give details of satellite including operator company
72 -- of inspectors with the following cins
73 -- ('38-7726916','01-8223240','53-1327041')
74
75 • SELECT
76       CONCAT(s.fname, ' ', s.mname, ' ', s.lname) AS 'inspector full name',
77       eqt.name AS 'Satellite name',
78       opr.name 'operator Company',
79       cs.orbit_type AS 'orbit type',
80       cs.purpose
81   FROM
82     EQUIPMENT eqt,
83     PARTNER opr,
84     COMMUNICATION_Satellite cs,
85     STAFF s,
86     INSPECTOR i
87 WHERE
88       i.STAFF_CIN = s.CIN
89       AND i.C_SAT_ID = cs.EQUIP_ID
90       AND cs.EQUIP_ID = eqt.EQUIP_ID
91       AND eqt.partner_org_code = opr.org_code
92       AND i.STAFF_CIN IN ('38-7726916' , '01-8223240' , '53-1327041');
93
94 -- 11-list maximum salary in each job_type
95 • SELECT job_type AS 'job type', MAX(salary) AS 'maximum salary'
96   FROM staff
97 GROUP BY job_type;
98
99 -- 12-retrieve the name of astronaut with maximum fitness in each crew
100 • SELECT
101       s.fname AS 'first name',
102       MAX(a.physical_fitness) AS 'maximum fitness',
103       c.name AS 'crew name'
104   FROM
105     staff s,
106     astronaut a,
107     crew c
108 WHERE s.cin = a.staff_cin
109     AND a.crew_id = c.crew_id
110 GROUP BY c.name;
111
112 -- 13-list the astronaut with maximum fitness in each university
113 • SELECT
114       a.staff_cin,
115       s.fname,
116       a.education,
117       MAX(a.physical_fitness) AS 'physical fitness'
118   FROM astronaut a INNER JOIN staff s ON s.cin = a.staff_cin
119 WHERE experience >= 7
120 GROUP BY a.education
121 ORDER BY 'physical fitness' DESC;
```

```

123 -- 14-list number of scientists for each speciality
124 • SELECT s.specialty, COUNT(s.STAFF_CIN) AS 'number of scientists'
125   FROM
126     SCIENTISTS s,
127     staff st
128 WHERE s.STAFF_CIN = st.CIN
129 GROUP BY s.specialty;
130
131 -- 15-list number of staff in each category of job_type
132 • SELECT job_type, COUNT(cin) AS 'number of staff'
133   FROM staff
134 GROUP BY job_type;
135
136 -- 16-show which mission has gone to planet with material of medium flexibility
137 • SELECT m.name AS 'mission name', p.name AS 'planet name', mat.name
138   FROM
139   (((mission m JOIN planet p ON m.planet_ID = p.planet_ID)
140     JOIN contains c ON p.planet_ID = c.planet_ID)
141     JOIN material mat ON c.material_ID = mat.material_ID)
142 WHERE c.material_ID IN (SELECT material_ID
143   FROM material
144     WHERE flexibility = 'medium')
145 GROUP BY mat.name;
146
147 -- 17-retrieve number of researches participated by partners
148 • SELECT
149   p.org_code,
150   p.name,
151   COUNT(c.research_ID) AS number_of_research
152   FROM
153     partcipate c,
154     partner p
155 WHERE
156   p.org_code = c.partner_org_code
157 GROUP BY p.org_code
158 ORDER BY p.name , p.org_code ASC;
159
160 -- 18-list staff's name from each job_type that takes salary higher than the avg of his job_t
161 • SELECT
162   Job_type, fname, salary
163   FROM
164     staff
165 WHERE
166   salary > ALL (SELECT
167     AVG(salary)
168     FROM
169       staff
170     GROUP BY job_type)
171 GROUP BY Job_type;
172
173 -- 19-retrieve each research assigned to mission
174 • SELECT
175   r.name AS 'research name', m.name AS 'mission name'
176   FROM
177     research r,
178     mission m,
179     assigned_to a
180 WHERE
181   r.research_ID = a.research_ID
182     AND m.mission_ID = a.mission_ID;
183
184 -- 20-calculate the cin ,name ,age and address of each male person in staff
185 • SELECT
186   cin,
187   fname,
188   mname,
189   lname,
190   CONCAT(build_no,
191     ',',
192     street_name,
193     ',',
194     postal_code,
195     ',',
196     city,
197     ',',
198     state,
199     ',',
200     country) AS address,
201   YEAR(CURDATE()) - YEAR(birth_date) AS age
202   FROM
203     staff
204 WHERE
205   gender = 'm';
206
207 -- 21-which telescope launched on spacecraft between 2016 and 2021
208 • SELECT
209   S.equip_ID AS 'space_telescope',
210   SC.name AS 'spacecraft name'
211   FROM
212     space_telescope S
213       NATURAL JOIN
214     spacecraft SC
215 WHERE
216   launch_date BETWEEN '2016-1-1' AND '2021-12-31';
217
218 -- 22-show all spacecrafnts with the space telescope launche on it (if exist)
219 • SELECT
220   SC.name 'spacecraft name', S.equip_ID AS 'space_telescope'
221   FROM
222     spacecraft SC
223       LEFT OUTER JOIN
224     space_telescope S ON S.spacecraft_ID = SC.spacecraft_ID;
225
226 -- 23-show spacecraft details that has space telescope launched on it
227 -- without the one with minimum focal_length
228 • SELECT
229   sc.name, sc.type, sc.launch_pad
230   FROM
231     spacecraft SC,
232     space_telescope S
233 WHERE
234   S.spacecraft_ID = SC.spacecraft_ID
235   AND S.diameter > (SELECT
236     MIN(focal_length) AS 'min focal length'
237     FROM
238       space_telescope);
239

```

```

240 -- 24-list connections between spacecrafts and communication satellites
241 • SELECT
242     s.name AS 'name of spacecraft',
243     e.name AS 'communication sat'
244 FROM
245     spacecraft s,
246     equipment e
247 WHERE
248     e.type = 'communication'
249         AND s.C_Sat_ID = e.equip_ID;
250
251 -- 25-retrieve number of active missions for each planet
252 • SELECT
253     p.name, COUNT(m.mission_id) AS number_of_active_missions
254 FROM
255     planet p,
256     mission m
257 WHERE
258     m.planet_ID IN (SELECT
259         p.planet_ID
260         FROM
261             planet)
262         AND m.status = 'active'
263 GROUP BY p.name;
264 -- 26-List the names of the astronauts who have a physical fitness score above the average
265 • SELECT
266     s.fname, a.physical_fitness
267 FROM
268     astronaut a
269         INNER JOIN
270             staff s ON s.cin = a.staff_cin
271 WHERE
272     a.physical_fitness > (SELECT
273         AVG(physical_fitness)
274         FROM
275             astronaut);
276
277 -- 27-show spacecrafts whose name has the second letter 'a' details
278 • SELECT
279     *
280 FROM
281     spacecraft s
282 WHERE
283     s.name LIKE '_a%';
284
285 -- 28-show all researches with their scientist names done without equipment
286 • SELECT
287     staff.fname, r.*
288 FROM
289     research r,
290     conduct c,
291     scientists s,
292     staff
293 WHERE
294     r.research_ID = c.research_ID
295         AND c.scientist_STAFF_CIN = s.STAFF_CIN
296         AND s.STAFF_CIN = staff.cin
297         AND c.equip_id = '';
298
299 -- 29-list the details of people with more than 3 phone numbers
300 • SELECT
301     s.cin,
302     s.fname,
303     s.city,
304     s.job_type,
305     COUNT(p.phone_no) AS 'number of phones'
306 FROM
307     staff s
308         JOIN
309             phone_number p ON p.staff_cin = s.cin
310 GROUP BY s.cin
311 HAVING COUNT(p.phone_no) > 3;
312
313 -- 30-retrieve planets with rings
314 • SELECT *
315 FROM planet
316 WHERE has_rings = 1;
317
318
319

```