DVAC concept logistical engineering

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Outline

1. MTBF and MTTR Analysis
2. Maintainance
3. PHS&T investigations
4. Spares
5. Consumables

1. MTBF and MTTR Analysis

➢ Reliability Model

Reliability model of antenna adopts a serial structure.

Total failure rate of the antenna:

$$\lambda_{dish} = \lambda_{reflector} + \lambda_{mount} + \lambda_{servo}$$

1. MTBF and MTTR Analysis

➢ Failure Rate of the Reflector

It's generally assumed the failure rate of the reflector is zero, that is $\lambda_{reflector}=0$

1. MTBF and MTTR Analysis

➢ Failure Rate of the Mount

No.	Name	Qty.	Failure rate (10^{-6}/h)	Total failure rate (10^{-6}/h)
1	Base pedestal	1	.000	.000
2	Azimuth pedestal	1	.000	.000
3	Azimuth encoder	1	10.253	10.253
4	Azimuth limit	1	5.900	5.900
5	Azimuth cable wrap	1	6.890	6.890
6	Azimuth bearing	1	2.000	2.000
7	Azimuth speed reducer	2	0.250	0.500
8	Azimuth motor	2	6.493	12.986
9	Elevation support and weight balance	1	.000	.000
10	Elevation encoder	1	10.253	10.253
11	Elevation limit	1	5.900	5.900
12	Elevation cable wrap	1	6.890	6.890
13	Elevation bearing	2	2.000	4.000
14	Elevation speed reducer	1	0.250	0.250
15	Elevation motor	1	6.493	6.493
16	Elevation leading screw	1	.000	.000
17	Elevation locking mechanism	1	1.180	1.180
18	Elevation locking motor	1	6.493	6.493
Total λ_{mount}				79.988

1. MTBF and MTTR Analysis

➢ Failure Rate of the servo system

No.	Name	Qty.	Failure rate (10^{-6}/h)	Total failure rate (10^{-6}/h)
1	ACU	1	10.000	10.000
2	Power	1	0.730	0.730
3	ADU	3	20.000	60.000
4	Contactor	4	2.000	8.000
5	Ventilating fan	2	2.400	2.400
6	Feed switch control	1	25.000	25.000
Total λ_{servo}				106.130

1. MTBF and MTTR Analysis

➢ Antenna MTBF

$\lambda_{dish}=_{reflector}+\lambda_{mount}+\lambda_{servo}=186.118$ $(10^{-6}/h)$

$MTBF=1/\lambda_{dish}=5373$ (h)

Based on the predicted MTBF, the antenna MTBF is determined as 5000h.

1. MTBF and MTTR Analysis

➢ MTTR Allocation

Assuming each antenna has a availability of 0.9999, then MTTR should be 0.5h.

2. Maintainance

Antenna maintenance includes two aspects:

- Routine inspection and maintenance
- Fault diagnosis and handling

2. Maintainance

➢ Routine Inspection and Maintenance

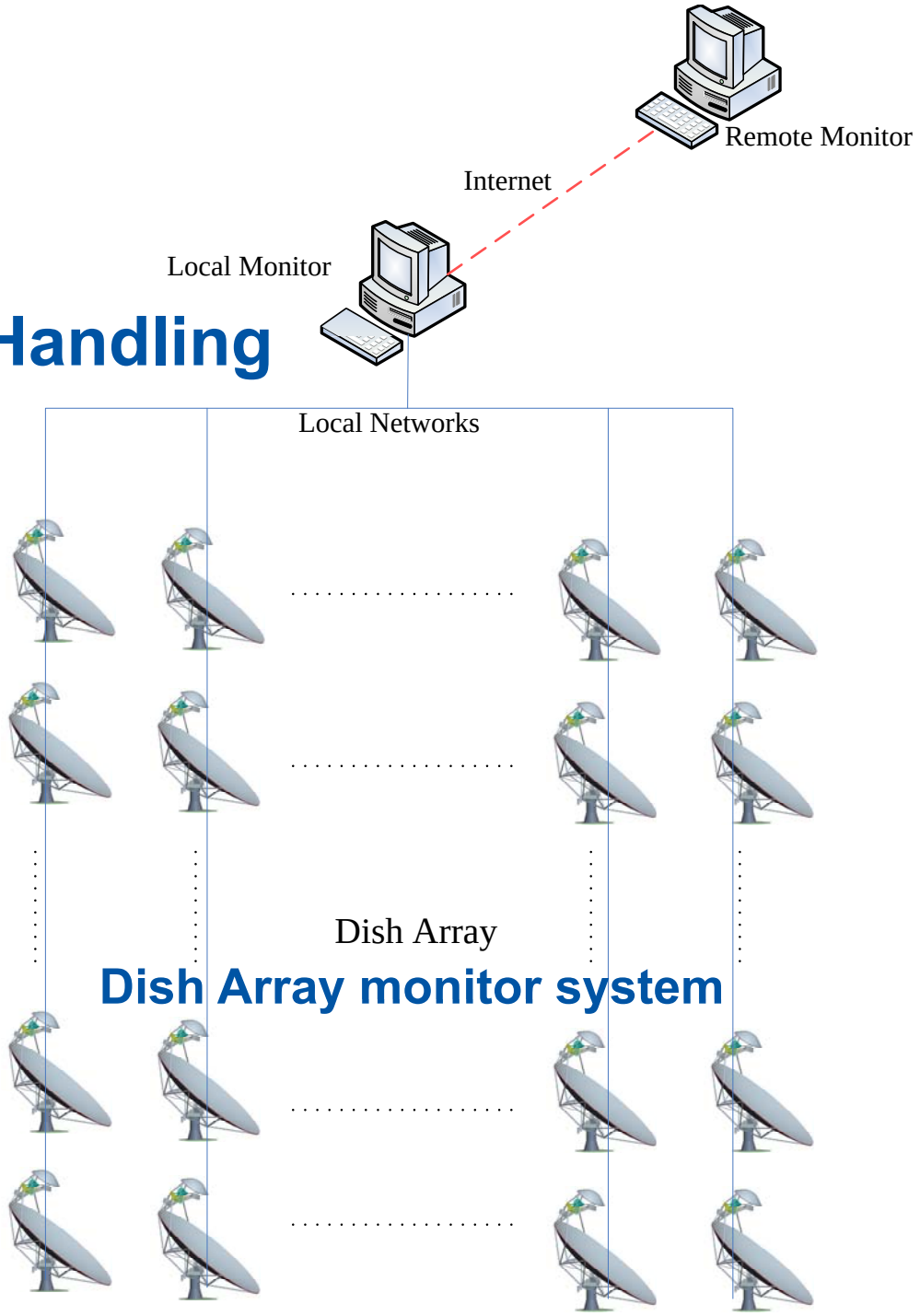
Inspection and maintenance on site is made once every half year.

- ✓ Check and lubricate the drive system
- ✓ Check if the connecting bolts are loose
- ✓ Check the water-proof performance and the surface coating. Repair the paint and seal the leakage when necessary
- ✓ Check the cable wrap and make sure the cable has no wear and tear and has not broken
- ✓ Clean any oil stain on the antenna surface
- ✓ Check the operation status of the servo system
- ✓ Check the power distribution, air conditioner and lightning protection facilities

2. Maintainance

➢ Fault Diagnosis and Handling

- ✓ Servo system of each antenna is provided with network interface
- ✓ A local monitor computer is set
- ✓ Collect and store the antenna status data via the local network
- ✓ Stored data can also provide basis for fault analysis like the black box on a plane
- ✓ Remote monitor to query status information by access to the Internet and logging in



2. Maintainance

➢ Fault Diagnosis and Handling

✓ JILRAT experts can obtain operation status of each antenna remotely and give fault diagnosis results and suggestions.

✓ Each “black box” monitors 100~300 antennas, 10~30 local black boxes are required for SKA.

✓ Network firewall and anti-virus software should be provided for each black box before it gets connected to the Internet.

✓ Black box can even be separated physically from the Internet in normal times and only connects to it when necessary.

3. PHS&T investigation

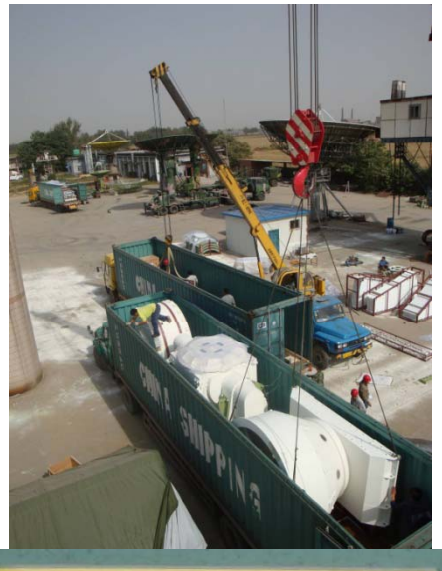
Packaging and Storage

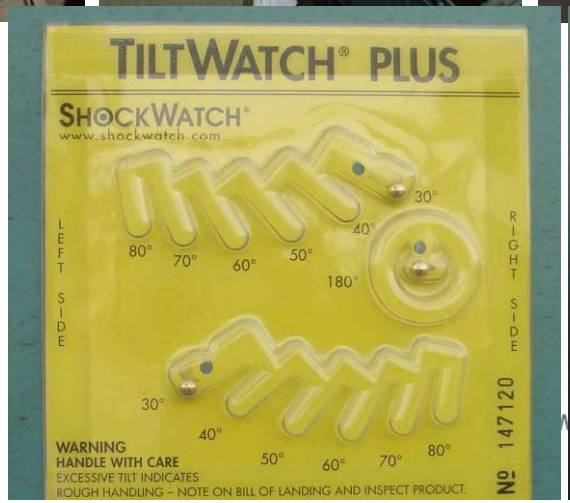
Specified storage environmental conditions will be defined. Before shipping, the QMG (quality management group) will perform final packaging inspections of antenna.

It will be ensured that each product is shipped completely and fully assembled, with the necessary documents, under the special requirements for shipping .

3. PHS&T investigation

Packaging and Storage





3. PHS&T investigation

Transportation

- **Make the distribution drawing of a cargo to ensure each batch of the cargo is properly settled in the container. This helps to load the cargo more efficiently and safely.**

- **Make the consignment list before each packaging of the cargo. The consignment list includes:**

  Item, Content, Qty, Dimension (unit) , Wgt (unit), Treatment Measures, Container No. , First Check by: (the member from OMG), Final Check (usually signed by the QA manager).

- **Make the transport protection notes (TPN) to make the cargo more safer.**

3. PHS&T investigation

Transportation

- Make a detailed list of how to pack the cargo, what tools and materials should be used for the package
- Insurance buying is needed. Another, photos should be taken in the process of onloading the cargo into the containers. All photos will be reserved as a good evidence
- Un-relevant material (e.g. leaves) should not be attached to the containers to clear quarantine.

4. Spares

Item	Qauatity(/25 dishes)
Switch, E-stop:	1
Limit switch:	1
Safety switch:	1
Motor:	1
Reducer:	1
Drive:	1
Screw :	1
Lighting rod :	1
Disc bearing :	1
Encoder :	1
Flexible-axis (for encoder):	1
Feed Switch Mechanism:	1

5. Consumables

#704 silicon glue: 5 tubes/25 dishes/2 years

Lubricating grease: 1kg/dish/year

END