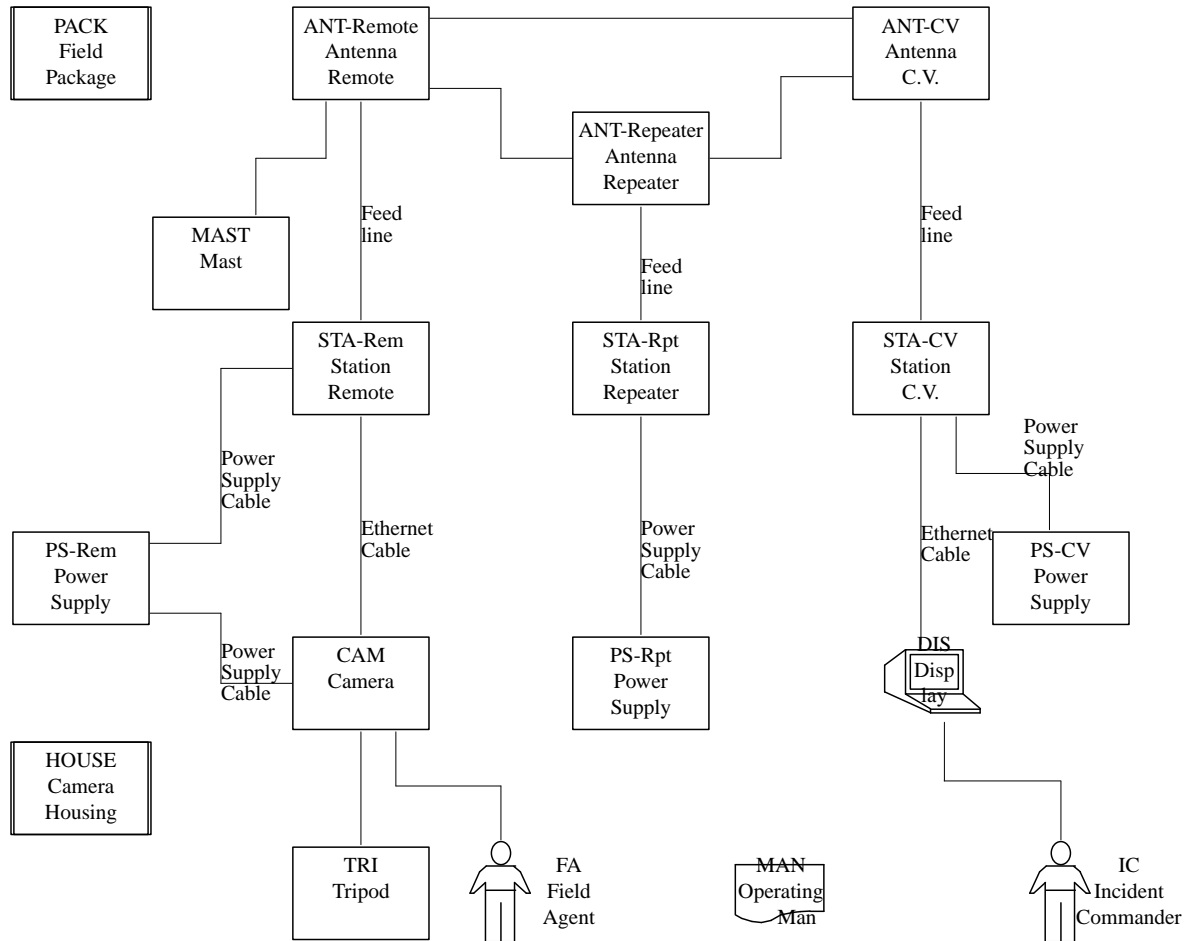


1. Introduction

This document describes the high level design for the Provide Scene Video project. The various hardware components are grouped into categories and described.

In the solution model selected, a repeater could optionally be provided at relatively low cost. The potential repeater components are only mentioned here, and not detailed.



In the following sections, many of the items include text like "This item explodes to the component...". This text indicates that there is/will be a specific make, model and supplier of a piece of hardware, and that specific detail may well be included in the solution model. However those details are not described in this document.

For each of the components, various requirements and reference documents are mentioned by code. These codes are briefly described at the end of this document. More complete discussion of these supporting references may be found in other documents.

2. Major Hardware Components

2.1. Item CAM - Camera

IP pan-tilt-zoom camera

The remote PTZ camera provides the video to be delivered to the C.V. The camera should provide for remote pan, tilt and zoom. The field of view should be adjustable from 15 degrees to 90 degrees.

The camera, perhaps with the help of a weatherproof enclosure, should be capable of operating in the range of weather typically encountered in central Michigan.

The camera must be lightweight, simple to set up, and be powered by a reasonably obtained DC power supply. High current requirements increase the weight of batteries that must be carried to the site.

Since the camera will sometimes be operated by a responder in haz-mat gear, the camera should not require adjusting small or hard to see controls.

This item explodes to the component CAM.

This element of the model is related to satisfying the following requirements:

- Engineering Requirement 04
- Engineering Requirement 05
- Engineering Requirement 06
- Engineering Requirement 07
- Engineering Requirement 08
- Engineering Requirement 09
- Engineering Requirement 17
- Engineering Requirement 19
- Engineering Requirement 21

This component is associated with:

- Reference Document: E02

CAM has been changed 7 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

2.2. Item DIS - Display

Video display

The display for the video needs to be some sort of computer, most likely a laptop, stored in the C.V.

The display will be operated by incident commanders under relatively good conditions. The command vehicle is typically clean, dry, and maintained at a comfortable temperature. Both AC and DC power are available in the command vehicle.

This item explodes to the component DIS.

This element of the model is related to satisfying the following requirements:

- Customer Requirement 02

This component is associated with:

- Reference Document: E01

DIS has been changed 6 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

2.3. Item STA-CV - Station C.V.

Mast-mounted 802.11b station.

A mast-mounted station to interface the ethernet display to the mast mounted antenna will be required. It might be possible that the station is integrated with the antenna.

The station should be relatively easy to deploy, since it will be stowed during transport and will need to be mounted on the C.V. mast at the scene.

The C.V. station will need power similar to the remote station, since the transmission of IP data must be bidirectional.

This item explodes to the component STA-CV.

This element of the model is related to satisfying the following requirements:

- Customer Requirement 01
- Customer Requirement 02
- Engineering Requirement 02
- Engineering Requirement 03
- Engineering Requirement 11
- Engineering Requirement 25
- Engineering Requirement 24

This component is associated with:

- Reference Document: E02
- Reference Document: E02

STA-CV has been changed 8 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

2.4. Item STA-Rem - Station Remote

Remote station

The remote station is needed to convert the ethernet video/data signal to R.F. for transmission to the C.V. It is likely that this station will require several watts of power.

This item explodes to the component STA-Rem.

This element of the model is related to satisfying the following requirements:

- Customer Requirement 08
- Customer Requirement 14
- Customer Requirement 15
- Customer Requirement 28
- Customer Requirement 30
- Engineering Requirement 11
- Engineering Requirement 12
- Engineering Requirement 13
- Engineering Requirement 15

This component is associated with:

- Reference Document: E11
- Reference Document: C05
- Reference Document: C06
- Reference Document: R07
- Reference Document: R11

STA-Rem has been changed 6 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

2.5. Item STA-Rpt - Station Repeater

Repeater

The repeater station may turn out to be no more than a wireless access point.

This item explodes to the component STA-Rpt.

STA-Rpt has been changed 4 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

3. Antennas

3.1. Item ANT-CV - Antenna C.V.

Command vehicle antenna

The command vehicle antenna will be mounted on the extensible mast at the rear of the C.V. It will need to be stowed for transport, so it must be capable of simple set up.

Some gain is desired here, but extreme directionality could be a problem. For these reasons, some sort of yagi or similar design may be appropriate.

In a possible implementation, the antenna is integrated with the station.

This element of the model is related to satisfying the following requirements:

- Customer Requirement 06
- Customer Requirement 12
- Customer Requirement 13
- Customer Requirement 18
- Engineering Requirement 11

This component is associated with:

- Reference Document: E09
- Reference Document: R03
- Category: System

ANT-CV has been changed 11 times. The last change was made by JJMcD on 2004-12-12. The design element was originally added by JJMcD on 2004-12-08.

3.2. Item ANT-Remote - Antenna Remote

Remote antenna

This antenna is designed to be deployed in the field by a responder. Because the responder will be encumbered by equipment and not likely to have a lot of time, the antenna should have little directionality.

This item explodes to the component ANT-Remote.

This element of the model is related to satisfying the following requirements:

- Customer Requirement 06
- Customer Requirement 08
- Engineering Requirement 11
- Engineering Requirement 12
- Engineering Requirement 13
- Engineering Requirement 14

This component is associated with:

- Reference Document: E09
- Reference Document: R03
- Reference Document: E11

ANT-Remote has been changed 6 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

3.3. Item ANT-Repeater - Antenna Repeater

The optional repeater antenna needs to be able to receive signals from the remote as well as the command vehicle. Setup must be extremely simple. In some cases, diversity antennas mounted on a wireless access point may be appropriate.

This item explodes to the component ANT-Repeater.

ANT-Repeater has been changed 6 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

4. Power Supplies

4.1. Item PS-CV - Power Supply

Command vehicle power supply.

The C.V. mounted station requires power. This may be supplied by the vehicle's 12 volt supply without any conditioning, depending on the specific requirements of the station.

In one example station, 18V @ 1A is required.

This item explodes to the component PS-CV.

This element of the model is related to satisfying the following requirements:

- Customer Requirement 14
- Customer Requirement 25
- Customer Requirement 29
- Engineering Requirement 25
- Engineering Requirement 35

This component is associated with:

- Reference Document: C05
- Reference Document: R02
- Reference Document: R09
- Reference Document: R07

PS-CV has been changed 8 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

4.2. Item PS-Rem - Power Supply

Remote power supply

The remote will require a power supply for the remote station and camera

This will most likely be a set of SLA batteries or perhaps lithium primary cells.

This item explodes to the component PS-Rem.

This element of the model is related to satisfying the following requirements:

- Customer Requirement 14
- Customer Requirement 29
- Engineering Requirement 12
- Engineering Requirement 25
- Engineering Requirement 35

This component is associated with:

- Reference Document: C05
- Reference Document: R08

PS-Rem has been changed 7 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

4.3. Item PS-Rpt - Power Supply

Repeater power supply

The repeater, if deployed, will require a power supply.

This item explodes to the component PS-Rpt.

PS-Rpt has been changed 4 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

5. Cables

5.1. Connection FD1 - Feed line

A feedline will be required to feed the remote antenna. Unlike the command vehicle side, it is probably not desirable to use a station integrated with the antenna.

Attributes of the connection	
3 m	2.4 GHz
50 ohm	

This connection explodes to the component FD1.

FD1 has been changed 6 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

5.2. Connection FD2 - Feed line

The optional repeater may require some sort of feedline.

This connection explodes to the component FD2.

FD2 has been changed 4 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

5.3. Connection FD3 - Feed line

The feedline connects the C.V. station to the antenna. Since the C.V. station should be mast mounted, the feedline should be quite short. It is possible that a solution involving an integrated station and antenna will be selected, in which case this feedline is not required.

Attributes of the connection	
0.5 m 50 ohm	2.4 GHz

FD3 has been changed 5 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

5.4. Connection ETH1 - Ethernet Cable

This connection carries the ethernet signal from the camera to the transmitter. It is expected to be CAT5e or better cable.

Attributes of the connection	
CAT6	5 m

This connection explodes to the component ETH1.

ETH1 has been changed 8 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

5.5. Connection ETH2 - Ethernet Cable

A long, weatherproof ethernet cable is required to connect the display to the station.

Attributes of the connection	
CAT6	3m

This connection explodes to the component ETH2.

ETH2 has been changed 8 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

5.6. Connection PSC1 - Power Supply Cable

A cable is required to deliver power to the camera.

Attributes of the connection	
2 m	500 ma

This connection explodes to the component PSC1.

PSC1 has been changed 5 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

5.7. Connection PSC2 - Power Supply Cable

A cable is required to deliver power to the remote station.

Attributes of the connection	
2 m	1 A

This connection explodes to the component PSC2.

PSC2 has been changed 6 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

5.8. Connection PSC3 - Power Supply Cable

The optional repeater will require a power supply cable.

This connection explodes to the component PSC3.

PSC3 has been changed 4 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

5.9. Connection PSC4 - Power Supply Cable

Power must be delivered to the mast mounted C.V. station. In some implementations, power is delivered over the ethernet cable, so a separate power cable is not required.

Attributes of the connection	
15 m	1 A

PSC4 has been changed 8 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

6. Miscellaneous Hardware Components

6.1. Item HOUSE - Camera Housing

Weatherproof housing

A weatherproof housing will be required for the camera.

In some examples, the housing might be ventilated. This is probably best avoided as this adds complexity, as well as requiring additional power.

This item explodes to the component HOUSE.

This element of the model is related to satisfying the following requirements:

- Customer Requirement 30
- Engineering Requirement 7
- Engineering Requirement 8
- Engineering Requirement 9

This component is associated with:

- Reference Document: R11

HOUSE has been changed 7 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

6.2. Item PACK - Field Package

Some sort of packaging will be required so that the field agent may transport the camera, remote station, antenna, power supply and associated cables to the incident.

This item explodes to the component PACK.

PACK has been changed 4 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

6.3. Item TRI - Tripod

Tripod

A tripod capable of supporting the camera at a height of at least 3 meters above the ground is required. In addition, the tripod will be expected to support the remote antenna.

This item explodes to the component TRI.

This element of the model is related to satisfying the following requirements:

- Customer Requirement 11
- Customer Requirement 15
- Engineering Requirement 10
- Engineering Requirement 12
- Engineering Requirement 23
- Engineering Requirement 24

This component is associated with:

- Reference Document: C03
- Reference Document: C06

TRI has been changed 6 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-08.

6.4. Item MAST - Mast

Remote mast

An extensible mast will be required at the remote station to support the antenna. This mast must be easily transported and set up. Ideally, the mast should be supported by the tripod. A height of approximately 10 feet is required.

MAST has been changed 2 times. The last change was made by JJMcD on 2004-12-11. The design element was originally added by JJMcD on 2004-12-11.

7. Reference Materials

7.1. Customer Requirements A number of customer requirements are referenced above. The following shows the short text associated with the customer requirement:

Requirement	Short Text
01	Video to CV
02	Keep ICs Together
03	Close view
04	Wide view
05	Once per month
06	1.5 Km from CV
07	Husband Frequencies
08	Single person
09	View far away
10	Telephoto
11	3m above ground
12	Interference to radios
13	Interference from radios
14	4 hour battery
15	Carried by operator
16	Audio
17	Inside building
18	Beyond LOS
19	Private
20	Multiple Cameras
21	Cable
22	Remote Pan
23	Remote Tilt
24	Remote Zoom
25	Lightweight
26	Redundant
27	Manual
28	Remote position
29	Serviceability
30	Bad Weather
31	Communicate w/ Oper

For a more detailed discussion of each of the customer requirements, see the Functional Decomposition document.

7.2. Engineering Requirements The preceding pages reference a number of engineering requirements. The following table shows the short description of the engineering requirements.

Requirement	Description
01	Spurs on Freq
02	Desense to CV radios
03	Desense from CV Radios
04	Width of view
05	Zoom Range
06	Number of cameras
07	Min op temp
08	Max op temp
09	Max op dewpoint
10	Lens height AG
11	Max distance from CV
12	Weight camera ass'y
13	Size camera ass'y
14	# Pieces camera ass'y
15	Operation around obstructions
16	Cable Capability
17	Remote pan
18	Remote pan angle
19	Remote tilt
20	Remote tilt angle
21	Compatible remote zoom
22	Remote positioning
23	Time for setup
24	Complexity of setup
25	Life of battery
26	Audio from fi eld
27	Number useable confi gs
28	Mean TTR
29	# frequencies required
30	Lowest freq required
31	Manual
32	Communication with operator
33	ERP
34	Video frequency
35	Battery memory

For a more complete discussion of the engineering requirements, see the Functional Decomposition document.

7.3. Reference Documents Some voice of the customer documents are referenced above. These reference documents collected during Measure as follows:

Reference	File Name
C01	VOC Collection - Commanders.xls
C02	VOC Collection - Commanders.xls
C03	VOC Collection - Commanders.xls
C04	VOC Collection - Commanders.xls
C05	VOC Collection - Commanders.xls
C06	VOC Collection - Commanders.xls
C07	VOC Collection - Commanders.xls
C08	VOC Collection - Commanders.xls
C09	VOC Collection - Commanders.xls
C10	VOC Collection - Commanders.xls
C11	VOC Collection - Commanders.xls
C12	VOC Collection - Commanders.xls
E01	VOC Collection - ES Director.xls
E02	VOC Collection - ES Director.xls
E03	VOC Collection - ES Director.xls
E04	VOC Collection - ES Director.xls
E08	VOC Collection - ES Director.xls
E09	VOC Collection - ES Director.xls
E11	VOC Collection - ES Director.xls
J03	VOC Collection - KC8TLJ.xls
R02	VOC Collection - RACES.xls
R03	VOC Collection - RACES.xls
R04	VOC Collection - RACES.xls
R05	VOC Collection - RACES.xls
R06	VOC Collection - RACES.xls
R07	VOC Collection - RACES.xls
R08	VOC Collection - RACES.xls
R09	VOC Collection - RACES.xls
R10	VOC Collection - RACES.xls

See the individual documents to identify the particular quotations which resulted in the corresponding requirement.