CHAPTER 2
ALTERNATIVES

2.1 THE GRAND CHALLENGE

The Grand Challenge is comprised of a series of events or phases further described below. All of the proposed action alternatives focus on the field testing phase (Phase 4) in which unmanned autonomous vehicles traverse portions of the Mojave and Colorado Desert regions. Each action alternative is described in Sections 2.4 through 2.7, including setup and operation for Phase 4 activities.

Phase 1 - Technical Paper. All participants must submit a technical paper describing the vehicle they plan to enter consistent with rules for safety and environmental considerations. DARPA will review the technical paper to ensure the vehicle design complies with the technical requirements and will conduct site inspections for each participant.

Phase 2 - DARPA Tech Conference. The Grand Challenge is being promoted to prospective participants in conjunction with DARPA's periodic technology conference. The 2004 Conference will be held in Anaheim the same week as the Grand Challenge field testing phase.

Phase 3 - Qualification Inspection and Demonstration (QID). All vehicles will be inspected, tested and required to demonstrate the ability to navigate safely at the California Motor Speedway. The Speedway provides a controlled environment to ensure vehicles are qualified to begin Phase 4, the field testing phase. The QID will confirm which vehicles are safe, able to navigate around obstacles, comply with performance testing, and operate consistent with the Challenge safety and control requirements. Any vehicle posing a safety or environmental threat will be disqualified. Following QID qualified vehicles will be transported to the starting area for the field test phase.

Phase 4 - Field Testing Phase. Following a final safety inspection at the selected starting area, qualified autonomous robotic vehicles would traverse the Mojave and Colorado Desert regions on a pre-determined route. This phase would be supported by a comprehensive safety control system including field spotters, control vehicles, a Challenge Operations Center, and law enforcement personnel from numerous agencies.

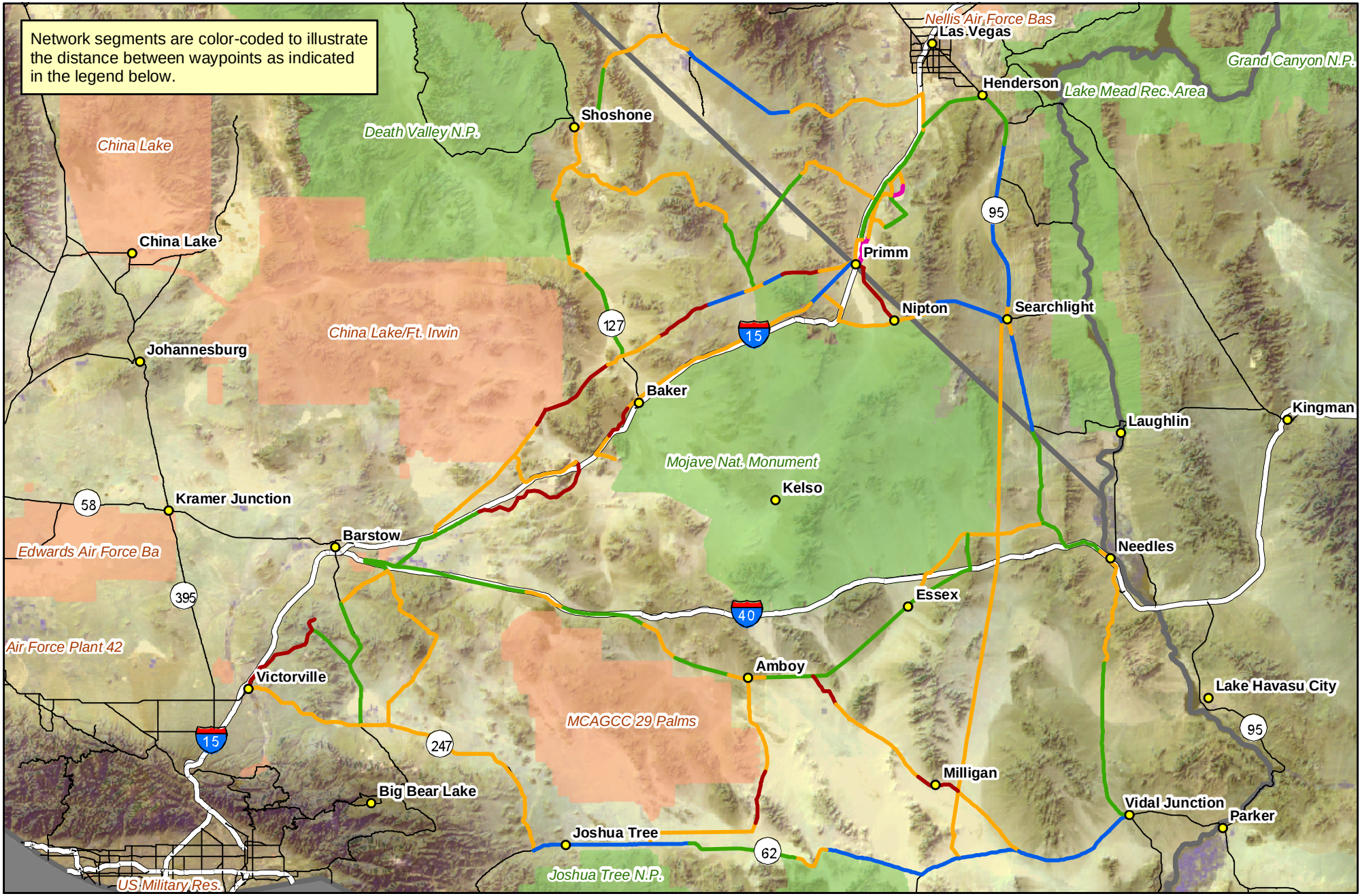
Phase 5 - Showcase of Challenge Vehicles. Following Phase 4, Challenge Vehicles would be showcased in Las Vegas, Nevada.

2.2 DESCRIPTION OF GRAND CHALLENGE ELEMENTS COMMON TO ALL ACTION ALTERNATIVES

The Grand Challenge would involve the operation of up to 25 autonomous robotic vehicles traversing the Mojave and Colorado Desert regions along a specific route. The field test and analysis phase of the Grand Challenge (Phase 4) is currently scheduled in 2004 for March 13 during daylight hours, with continuation to the 14th if necessary to complete the event. Backup dates for field testing in 2004 include March 20 and March 21. The backup dates would be used if the event could not be held or completed due to time constraints, environmental or weather conditions or if safety measures were not fully functional. Possible dates for field testing in 2005 through 2007 will be determined following the 2004 event, but would occur within the parameters of the Memorandum of Agreement between the BLM and DARPA. All Challenge Vehicles would operate in BLM designated OHV areas classified for Intensive Use, on BLM designated open routes in areas classified for Intensive, Moderate or Limited use or on public roads. Relevant areas would be closed to the public during operation of the event and re-opened as the portion of the event occurring in these areas is completed.

DARPA will have complete control over all Challenge Vehicles, including the ability to start and stop navigation and operation of the vehicle at any time. When navigating, Challenge Vehicles would be unmanned and fully autonomous, with navigation controlled by an onboard computer. Sensors would interpret the environment, and based on what is sensed, the onboard computer would control the navigation of the vehicle along the specified route.

Vehicles would navigate from point to point (waypoint) as defined in a computer file that identifies the route to be followed and other navigational parameters. Each waypoint is a specific location on the ground, similar to latitude and longitude. The specific route is defined by a series of waypoints. The spacing between each waypoint varies depending on the road characteristics including how straight or irregular the roadway is, and the varying terrain and elevation. The more complex the roadway, the more waypoints are required to properly define it. Exhibit 2 identifies the number of waypoints needed to define various route segments. The computer file also defines the width of each road segment that the vehicle is able to operate within between waypoints. On approved routes of travel and public roads the maximum width is the roadway. In open areas, the widths may be much greater, allowing vehicles to determine their own route and evaluate the best way to get between two waypoints. The computer file defines speed limits for each route segment based on safety factors including terrain, local jurisdiction speed limits, and road obstacles, such as rail road crossings and utility infrastructure, so that speed limits would be matched to terrain and obstacles. On public roads in towns, local speed limits will be observed. The maximum speed limit on roadways would be 75 miles per hour (mph), and 25 mph in critical habitat areas. No speed limit will be defined in open areas, except where necessary to minimize hazards due to potential impacts with road obstacles.



Data Sources: MDEP, BLM, SRA/DARPA

Populated Places
Freeway
Road
State Boundary
<150 ft
150-300 ft
301-500 ft
501-1000 ft
>1000 ft
Department of Defense Areas
Federal Parks

0 12.5 25 50
Miles

NORTH

Michael Brandman Associates

Exhibit 2

Waypoint Spacing

Based on these parameters, the average maximum speed for Challenge Vehicles over the course of the event is expected to be approximately 35 mph.

In addition to the operation of the Challenge Vehicles there would be a number of people and other vehicles associated with the event. There would be start and finish areas with DARPA staff, participant staging, event logistics (i.e., media, medical, etc.), and spectators. Along the route there would be control vehicles, stationary route monitors, media and spectator viewing areas, route marking teams, administrative sweeps, desert tortoise sweeps, road crossing/closure crews, and communications network support. These activities are more fully described in Section 2.2.1 below.

Helicopter or other aircraft may be used to observe and document the event. DARPA Staff in helicopters would also be able to provide additional information to the ground staff. Aircraft would be flown at an elevation so that no ground disturbance would be created. Federal Aviation Administration guidelines will be followed, including obtaining the appropriate FAA clearance, if required. Aircraft would not be used in the event of hazardous weather conditions.

2.2.1 Grand Challenge Activities and Operation Support

Each of the activities associated with the field testing phase and common to all action alternatives is described below. The specific number of people and vehicles associated with each activity is identified in Table 2-1. Operations support would be needed for each day the field testing phase is conducted. No new surface disturbance will be permitted by the Grand Challenge event. All activities will occur within the footprint of existing high-use areas, including BLM-designated open areas, BLM-designated routes, private lands, and paved public roads.

Start Area Site. The start site would contain team staging, parking, support and logistics, spectator seating, restrooms and trash collection. DARPA staff would establish designated parking and crowd control to constrain all activity to private land, where applicable, in cooperation with local law enforcement. Restrooms or portable toilets would be provided consistent with BLM requirements.

Route Marking. Forty-eight hours prior to the event and within 24 hours following the event, DARPA personnel in administrative vehicles would traverse portions of the route to put in place and remove route markings and protective barriers. Route markers would be used in certain areas to ensure that vehicles can identify or sense the route boundaries; such areas might include railroad rights-of-way, sensitive/critical habitats, utility infrastructure, etc. Markers would consist of staking and possibly raised snow fencing and would be placed in the roadway, so that no new disturbance would occur. All route markings and protective barriers would be removed within one day of the completion of the event. Authorized

biologists approved to handle desert tortoises would support the route marking teams to monitor for desert tortoises and desert tortoise burrows.

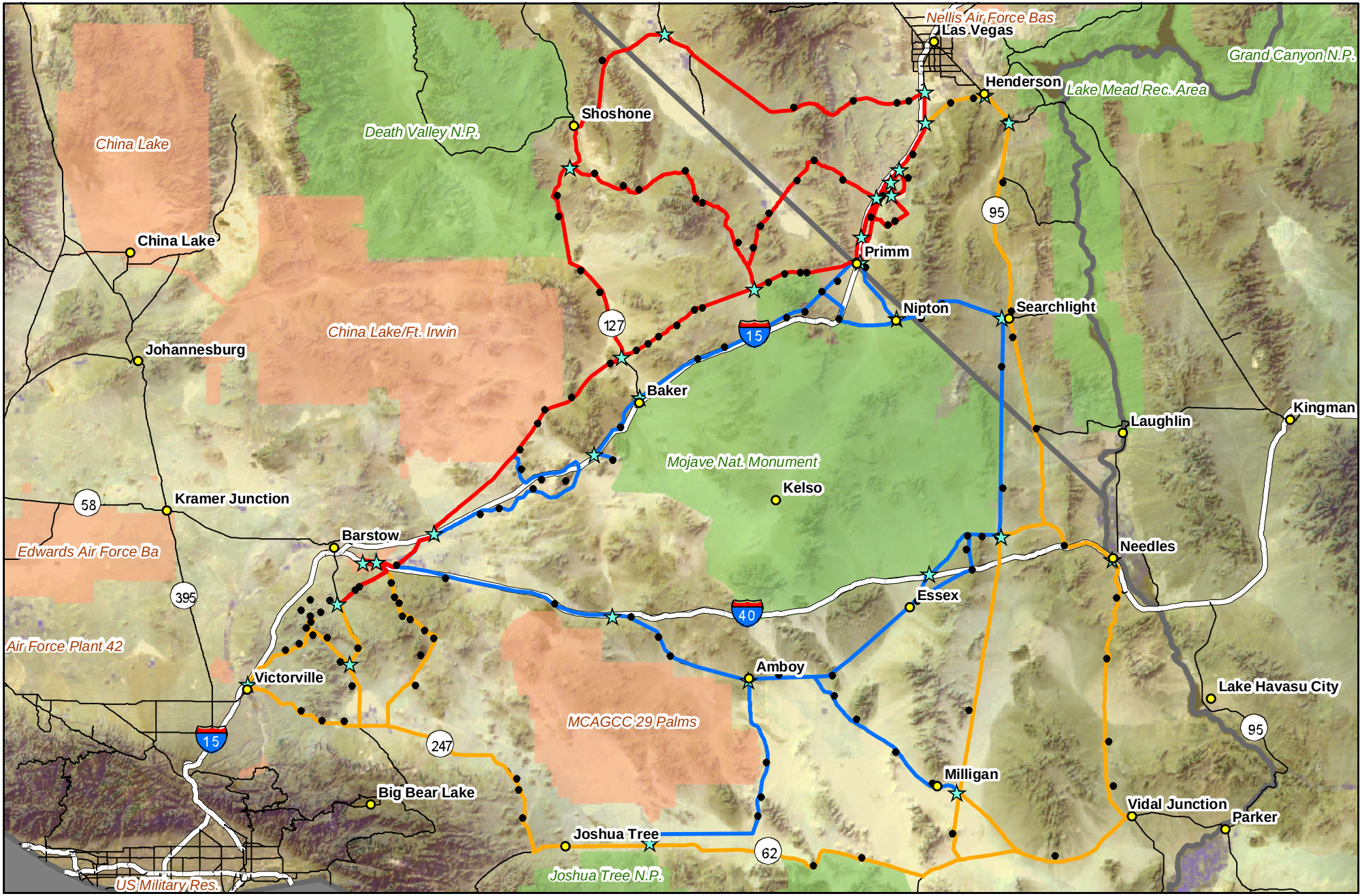
Administrative Sweeps. DARPA staff in administrative vehicles would traverse the route in advance of Challenge Vehicles to verify all safety and logistics measures, and to monitor for the presence of desert tortoises consistent with the protective measures.

Desert Tortoise Sweeps. Authorized desert tortoise biologists (approved by the U.S. Fish and Wildlife Service [Service or USFWS] to handle desert tortoise) would precede the Challenge Vehicles by no more than an hour as part of conducting rolling sweeps of the selected route in order to ensure that desert tortoise are not on the road when vehicles come through. A biologist would monitor any desert tortoise encountered until all vehicles associated with the event are clear of the relevant route segment.

Challenge Vehicle/Control Vehicle Operation. Challenge Vehicles would traverse a specific route from start to finish. To ensure that vehicles stay on the route, a control vehicle would follow each Challenge Vehicle from the start to the finish. The control vehicle following the Challenge Vehicle would have the ability to stop the vehicle if it were to leave the roadway or pose a safety or environmental threat. Two to four people would be in the control vehicle following the Challenge Vehicle.

Route Monitors. Route monitors would be positioned adjacent to the route at specified points to observe Challenge Vehicle operation and assist in monitoring and control. The positions would be selected to allow for a good vantage point. Monitors would observe vehicles to ensure proper operation and ensure that there are no safety obstacles such as a pedestrian, unauthorized vehicle, or encroachment beyond the roadway. They would also be able to visually identify the presence of a desert tortoise on the route and relay the information to the Control Vehicles. Monitoring locations for each route segment are identified in Exhibit 3. Only those positions along the actual route used for the event would be utilized. Route monitors will access their positions by first using available paved roads, and then unpaved access roads. Depending on the specific position, it may be necessary to drive on the route. The intent is to minimize use of unpaved roads, and minimize miles traveled on the route. Monitors would park off the route or adjacent to the route in existing disturbed areas or in an area where the roadway is very wide.

Media Observation Points. Observation points would be designated where the route intersects major public roads for team member and media representatives to monitor the event. Each observation point would be located on or adjacent to existing major roads with adequate shoulder parking or within OHV areas. Observation points would be controlled by DARPA staff to ensure that only designated team members and media are present, and to ensure that attendees remain in the observation point area. Media observation points for each route network are identified in Exhibit 3. Only those positions along the actual route used for the event would be utilized.



Data Sources: MDEP, BLM, SRA/DARPA

Populated Places
Monitoring Points
Media Locations
Freeway
Road
State Boundary
Northern_Route_Network
Central_Route_Network
Southern_Route_Network
Department of Defense Areas
Federal Parks

0 12.5 25 50
Miles

NORTH

Michael Brandman Associates

Exhibit 3

Route Networks

Spectator Viewing Areas. In addition to the start and end areas, up to two media observation points would also serve as spectator areas where routes intersect paved roads that provide sufficient informal parking areas. DARPA staff would control both people and parking in this area for safety and trash control. Private land owners will be consulted for use of property, where applicable.

Recreational and Road Closures. Affected OHV areas, designated open routes, and public roads would be closed to the public preceding and during operation of the event, and re-opened as the portion of the event occurring in these areas is completed. Road closures would be posted and orchestrated in coordination with local law enforcement agencies. Road closures would be staffed and road closure personnel would reach their assigned crossings via the public roads and would not traverse the event route.

While it is recognized that the final numbers of closure points and needed resources could vary depending upon the selected route, below is a rough estimate of the type and amount of equipment and personnel needed to safely control a route during the Grand Challenge Event. For most closure points, only one or two flagmen will be needed. It is also assumed that sawhorse barricades and freestanding trail markers will be used to block off roads. No equipment or material is expected to result in ground disturbance beyond setting sawhorses or freestanding trail markers on top of the soil surface.

The final decision on which roads will be closed will be made after a final route has been selected and that route further analyzed by DARPA, the BLM, California Highway Patrol and the San Bernardino County Sheriff's Department. However, it is anticipated that there would be approximately 55 to 60 closure points along a given route, requiring up to 90 sawhorse barricades, 65 trail markers, and 60 flagmen/personnel. Authorized desert tortoise biologists would support closure personnel by monitoring for desert tortoise and desert tortoise burrows at each closure point.

Communications Network. A communications network would be provided over the entire route used for the Grand Challenge to allow all members of the DARPA staff, including support personnel and authorized desert tortoise biologists in the field, to communicate with the command center as well as with each other during the event. The network would be achieved by installing a temporary communication repeater on existing communication towers. In addition, up to six trucks equipped with temporary communications equipment would be parked along roadways near the route.

Finish Area Site. The finish site would provide support required for DARPA staff and spectators. DARPA staff, in cooperation with local law enforcement and other authorities would establish designated parking and crowd control to constrain all activity to private land, where applicable.

TABLE 2-1
ESTIMATED VEHICLES, PERSONS AND LOCATIONS
RELATED TO GRAND CHALLENGE ACTIVITIES

Activity	Vehicles[1]	People	Location
Start Area	3 / 0 100 / 0 150 / 0	100 DARPA staff 250 team members 2,000 spectators	On private property.
Route Marking	5 / 5	20 DARPA Staff	On route.
Administrative Sweeps	3 / 3	9 DARPA Staff	On route.
Desert Tortoise Sweeps	10 / 10	10 DARPA staff 20 Authorized desert tortoise biologists	On and adjacent to route.
Challenge Vehicle / Control Vehicle Operation	25 / 25 25 / 25	 100 in control vehicles	On route.
Route Monitors	20 / 20	100 route monitors	Elevated view of route at up to 50 locations. Route monitors will access each location on foot.
Media Observation Points	10 / 0 25 / 0 30 / 0	10 DARPA Staff 50 team representatives 60 media representatives	Observation points within short distance of road to provide vantage point. Parking on the shoulder of major public roads at 10 specific locations.
Spectator Viewing Area	5 / 0 80 / 0	20 DARPA Staff 200 spectators	Adjacent to paved highways with ample existing parking at two locations.
Road Closures/Crossings	50 / 0	100 DARPA Staff 50 BLM staff and Law Enforcement	Road intersections, OHV area intersections and other high traffic public areas.
Communication Network	6 / 0	12/0	Adjacent to paved highway with ample existing parking at six locations.
Finish Area	3 / 0 100 / 0 500 / 0	75 DARPA staff 250 team members 2,000 spectators	On private property.
Total	**436 / 88[2]**	**2,809 / 254[2]**	

Notes: [1] The first number indicates the number of vehicles or people associated with the activity. The second number indicates the number of vehicles or people that would be allowed on the route at some point in support of field testing phase or as a participating vehicle.

[2] This number has been adjusted to account for overlap in vehicles and staff associated with the event. For instance persons and vehicles at the start area are also expected at the finish area or other activity areas.

2.3 DEVELOPMENT OF ALTERNATIVES AND ROUTE SEGMENT SELECTION

Consistent with the purpose and need for the Grand Challenge, the Mojave and Colorado Desert regions meet the criteria established by DARPA for the field testing phase. Given the propensity of BLM lands in this area, DARPA conferred with the BLM and began identifying route segments and areas that would be appropriate for the field testing phase of the event. The National Park Service was also contacted about routes through the Mojave National Preserve. Only one route will actually be used to conduct the field test, but it will only be announced to participants two hours prior to the start of the event. This ensures that the participants do not pre-run the route, and that the event is a test of navigation technology. Route

segments were identified with the BLM's input and alternatives were developed with consideration of the following items consistent with the criteria for the objectives for the Grand Challenge field testing phase identified in Section 1.1:

- *Provides operational challenge in terms of varied terrain consistent with a realistic military application (criteria 1).* Under a realistic military application vehicles are likely to encounter a variety of terrain conditions including unsurfaced roads, navigational obstacles such as stream crossings, mud, fine sand, steep roadways, and rocky surfaces.

- *Provides operational challenge in terms of a semi-linear distance and traverse that pushes the limits and difficulty of operating vehicles, consistent with a realistic military application. Practical distance should be at least 100 miles, consistent with vehicle being delivered in a safe area and traversing into hostile territory (criteria 2).* Repeated segments of looped courses, which could be memorized by the vehicle's computer /sensing technologies, would not contribute to the testing of the technology.

- *Includes at least one competitive segment (criteria 3a*). The competitive component is important to attract potential innovators that would not otherwise be interested in defense projects. This also allows for observation of the vehicles' navigational response to other vehicles.

- *Allows for traverse generally between the vicinity of Metropolitan Los Angeles and the vicinity of Las Vegas, Nevada (criteria 3b, c*). This would effectively tie the events/phases of the Grand Challenge together. It would also be accessible to a regional technology center for autonomous vehicle technology in southern California.

- *Variety of route segments which allow the level of difficulty to be tailored to the capability of qualified vehicles (criteria 4a)*. Since the Grand Challenge is testing an emerging technology, the capability of the Challenge Vehicles that will qualify to participate is speculative. Having a variety of terrain options provides flexibility that would enable the route to be selected based on the capability of the vehicles.

- *Specific start and end locations that support logistics for the event including: ample lodging for participants and support personnel, communications infrastructure, accessibility to major highways, and significant area to allow staging, parking, etc. (criteria 4b).*

Based on these criteria, DARPA and the BLM jointly developed alternatives further described in Sections 2.4 through 2.9, including those alternatives considered but eliminated from further consideration. All action alternatives include the use of OHV areas, open routes, and public roads.

2.4 NORTHERN NETWORK ALTERNATIVE 1

Approval of the Northern Network Alternative would allow the Grand Challenge field test to be conducted along a route within a northern network of route segments. The proposed network is further described below and identified in Exhibit 3.

2.4.1 Description of the Northern Network

The northern network begins on the open desert floor in the Stoddard Valley OHV area. Leaving Stoddard Valley, the network crosses Route 247 and proceeds northeast over Daggett Ridge. It veers back to the northwest on Camp Rock Road (connection to southern network), following Pendleton Road to Nebo Road to National Trails Highway. East of Daggett the northern network leaves National Trails Highway (connection to central network) and continues on a north-east power line road to a rail road right-of-way. The northern network follows the rail road (connection to central network) to Hacienda Drive, at which point it crosses Interstate 15 (I-15) and intersects a north-east power line road. Where the power line road intersects Route 127, the upper branch of the network heads north on Route 127 while the lower branch continues on the power line road and arrives at Primm Nevada from the southwest. The upper branch follows Route 127 to Route 178 to Route 372 to Route 160, which crosses I-15 south of Las Vegas. It then intersects Old Las Vegas Boulevard south and follows local trails and roads to arrive at Primm Nevada. A middle branch deviates from the upper branch at Furnace Creek Road, proceeding to Furnace Creek Road to Excelsior Mine Road, and either reconnecting to the lower branch on the east-west power line or heading east on Kingston Road to Route 161 which crosses I-15 north of Primm and rejoins the upper branch.

In terms of navigation difficulty, route segments within the northern network contain terrain conditions ranging from level to very steep, and smooth to highly rugged and rocky, with the most rugged conditions in the southeastern half of the route. Soil terrain conditions on unpaved route segments range from a hard packed surface to medium grained sand near the Mojave River. This route is considered difficult in terms of terrain conditions (rugged, steep, rocky) and moderate in terms of navigational obstacles (terrain, sandy soil conditions).

2.4.2 Suitability of the Northern Network Alternative 1

This alternative would be suitable for a vehicle with moderate to high endurance and navigational capability. Vehicles with low endurance and navigational capability would not be suitable for unpaved roads in the eastern portion of the network. In the event that vehicles of such capability were qualified, a large portion of the specific route (upwards of 50%) would be limited to paved roadways. Such a high portion of paved roadways would not be highly useful in evaluating the vehicle technology. Based on these conditions the Northern Network Alternative 1 would be moderately suitable towards meeting the purpose and need of the Grand Challenge.

2.5 CENTRAL NETWORK ALTERNATIVE 2

Approval of the Central Network Alternative would allow the Grand Challenge field test to be conducted along a route within a central network of route segments. The proposed network is further described below and identified in Exhibit 3.

2.5.1 Description of the Central Network

The central network begins on the open desert floor in the Stoddard Valley OHV area. Leaving Stoddard Valley, the network crosses Route 247 and proceeds northeast over Daggett Ridge. It veers back to the northwest on Camp Rock Road (connection to southern network), following Pendleton Road to Nebo Road to National Trails Highway. East of Daggett, the central network splits into an upper and lower branch. The upper branch continues on a north-east power line road to a rail road right-of-way, which it follows northeast to Afton Canyon. Upon exiting the canyon it proceeds through the Rasor OHV area, departing via either Basin Road or Rasor Road. Via Basin Road this branch picks up the Arrowhead Trail to the west and joins the northern network on an east-west power line road. Via Rasor Road the upper branch of the central network follows the Arrowhead Trail and power line roads to the northeast, through Baker and over Clark Mountain. From that point it continues into Primm from the southwest, or joins Route 164 and connects to the lower branch.

The lower branch of the central network continues on National Trails Highway from Daggett to the southeast. It can connect to the southern route network via Amboy or Cadiz Roads, or continue on National Trails Highway to either Goffs Road (connection to southern route) or Mountain Springs Road. From there it heads north along a north-south power line road and intersects Route 164 near Searchlight. Route 164 heads back to the west and the lower branch either reconnects to the upper branch southwest of Primm, or enters Primm from the southeast via Nipton Desert Road and a rail road right-of-way.

In terms of navigation difficulty, route segments within the Central network contain terrain conditions ranging from level to moderately steep, and smooth to moderately rugged. Soil terrain conditions on unpaved route segments range from hard packed surface to very fine sand/silt. Navigational obstacles specific to this network include wet stream crossings and very fine sand and potentially mud, depending on weather conditions. This route is considered moderate in terms of terrain conditions (moderately rugged, moderately steep) and difficult in terms of navigational obstacles.

2.5.2 Suitability of the Central Network Alternative 2

This alternative would be suitable for a vehicle with moderate to high endurance and navigational capability. Vehicles with low endurance and navigational capability would not be suitable for unpaved roads in the north-central portion of the network. In the event that vehicles of such capability were

qualified, a large portion of the specific route (upwards of 75%) would be limited to paved roadways. Such a high portion of paved roadways would not be highly useful in evaluating the vehicle technology. Based on these conditions the Central Network Alternative 2 would be moderately suited towards meeting the purpose and need of the Grand Challenge.

2.6 SOUTHERN NETWORK ALTERNATIVE 3

Approval of the Southern Network Alternative would allow the Grand Challenge field test to be conducted along a route within a southern network of route segments. The proposed network is further described below and identified in Exhibit 3.

2.6.1 Description of the Southern Network

The southern network begins on the open desert floor in the Stoddard Valley OHV area. It can depart Stoddard Valley either to the northeast or south. The northeastern departure proceeds south on Route 247 to Lucerne Valley, or crosses Route 247 and proceeds northeast over Daggett Ridge and south on Camp Rock Road to Lucerne Valley. The southern departure from Stoddard Valley utilizes the Lucerne Valley Cutoff to Route 247, or follows Stoddard Wells Road toward Victorville and Route 18 to Lucerne Valley. From Lucerne Valley the southern network continues southeast on Route 247 into Yucca Valley, where it intersects Route 62 east to Twenty-Nine Palms. In Twenty-Nine Palms the southern network connects to the central network via local roads and Amboy Road, or continues east on Route 62. Off of Route 62 the southern network can head north on Iron Mountain Road or Cadiz Road (connection to central route), follow a north-south power line road to Goffs Road (connection to central route), and head east to Route 95. Alternately, it can continue on Route 62 to Vidal Junction and travel north on Route 95 directly. Route 95 continues north to Searchlight, where the southern network can connect to the central network via Route 164, or continue north into Henderson, southwest on Route 146 to Old Las Vegas Boulevard, and south along local trails and roads to arrive at Primm Nevada.

In terms of navigation difficulty, route segments within the southern network contain terrain conditions ranging from level to moderate, and smooth to moderate. Soil terrain conditions on unpaved route segments range from a hard to a medium packed surface. This network contains the largest portion of paved roads compared to the Northern Network Alternative 1 and Central Network Alternative 2. This route is considered easy to moderate in terms of terrain conditions (moderate) and easy in terms of navigational obstacles.

2.6.2 Suitability of the Southern Network Alternative 3

This alternative would be suitable for a vehicle with moderate endurance and low navigational capability. Vehicles with high endurance and high navigational capability would not be challenged by this route

consistent with a realistic military application due to the high proportion of paved roadways (upwards of 90%). Such a high portion of paved roadways would not be highly useful in evaluating the vehicle technology. Based on these conditions the Southern Network Alternative 3 would be poorly suited towards meeting the purpose and need of the Grand Challenge.

2.7 COMBINED NETWORK ALTERNATIVE 4

Approval of the Combined Network Alternative would allow the Grand Challenge field test to be conducted on any of three routes within the combined network, with an allowance for the use of two routes in subsequent years, subject to changing conditions.

2.7.1 Description of the Combined Network

The Combined Network is comprised of the combined network of route segments for the Northern, Central and Southern Networks described under the previous alternatives 1, 2, and 3, respectively.

2.7.2 Suitability of the Combined Network Alternative 4

This alternative would provide a wide variety of terrain conditions from level to steep, smooth to rugged and rocky. This alternative would provide the most flexibility in defining a route that can be best matched to the quality of the qualified vehicles participating in the Grand Challenge, compared to the other alternatives. As a result, the Combined Network Alternative 4 would be highly suited towards meeting the purpose and need of the Grand Challenge.

2.8 NO ACTION ALTERNATIVE

Under this alternative, the Grand Challenge would not be conducted on BLM lands.

2.9 ALTERNATIVES CONSIDERED AND ELIMINATED FROM FURTHER ANALYSIS

Other alternatives were considered but eliminated because they did not meet criteria related to the purpose and need for the Grand Challenge identified in Section 1.2, or were otherwise infeasible. A brief discussion of each alternative considered and the basis for eliminating them follows.

2.9.1 Johnson Valley to Parker Dam

Under this alternative the field test would be held on a route network using the Johnson Valley OHV area, the Parker Strip Recreation Area and additional trails both northwest and east of the Recreation Area. Routes considered included a traverse from Johnson Valley to the Parker Dam area. The starting area for

this alternative lacks the necessary infrastructure to support logistics, seriously hindering the feasibility of this alternative. The extended route could not realistically be completed in one day.

2.9.2 Mojave National Preserve Route

This alternative would include route segments through the Mojave National Preserve (Preserve), including paved roadways. DARPA met with National Park Service (NPS) officials to discuss a potential route through portions of the Preserve. The NPS indicated that any routes through the Preserve would be inconsistent with the mission and management goals for the Preserve.

2.9.3 Military Installation Route

This alternative would include route segments either through or entirely contained within Military Installations in the Mojave and Colorado Desert regions. There are a number of security limitations associated with use of military lands which would hinder operation of the field test phase. Such limitations would require advance screening of organizers, participants, spectators, and press. These limitations would not only hamper the operation from a logistical standpoint, but would also be contrary to the purpose and need in that it is likely to dissuade some of the non-Department of Defense innovators the Grand Challenge has been designed to attract. Military security requirements could also prohibit the inclusion of the public and non-traditional innovators. The primary purpose and use for the military lands in the Mojave and Colorado Desert regions is to provide training for military personnel. The lands are used extensively, and on a nearly daily basis, and on a regular rotating schedule. The Grand Challenge field testing would interfere with training operations of the military. The potential presence of hazards such as sharp metal fragments or live ammunition is also of concern.

2.9.4 Off-Highway Vehicle Area Alternative

This alternative would allow the Grand Challenge field test to be conducted in up to two OHV areas in the Mojave and Colorado Desert regions. Areas considered include Stoddard Valley, Johnson Valley, Rasor and/or an area near Primm Nevada. A recreational closure would be imposed for the area(s) used during the event, closing up to 75 percent of two OHV areas or 100 percent of one. Conducting the field test phases exclusively within the OHV areas would not be consistent with Challenge goals for a realistic military application because they are generally homogenous in their terrain and lack sufficient area to provide enough distance for a semi-linear traverse. As a result this alternative would not be consistent with the purpose and need for the Grand Challenge.