(화제) 후쿠시미 다이이치 핵 발전소 재앙에 로봇 구조 팀 파견 **(1-4)** **JFKN.COM**

More than 7 years have passed since a monster earthquake and tsunami struck northeast Japan and triggered what became after Chernobyl. the worst nuclear disaster in history at the Fukushima Daiichi Nuclear Power Plant. When three of its six reactors melted down, hot fuel turned to **molten lava** and burned through steel walls and concrete floors. To this day no one knows exactly where inside the reactor buildings the fuel is. And it is so deadly, no human can go inside to look for it. So the Japanese company that owns the **crippled plant** has turned to robots.

There are **four-legged** robots, robots that climb stairs and even robots that can swim into reactors flooded with water. They're equipped with 3D scanners, sensors and cameras that map the **terrain**, measure radiation levels and look for the missing fuel. This is part of a massive cleanup that's expected to cost nearly $200 billion and take decades. “Has anything like this cleanup, in terms of the **scope**, ever happened before? No, this is a unique situation here. It's never happened in human history. It's a challenge we've never had before.”

Lake Barrett is a nuclear engineer and former Department of Energy official who **oversaw** the cleanup of the worst nuclear accident in U.S. history, Three Mile Island. He was hired as a senior adviser by TEPCO, the Tokyo Electric Power Company that owns the plant and is in charge of the effort to find the missing fuel. He's also advising on the development of new robots like this six-legged spider robot that engineers are designing to **hang from scaffolding** and climb onto equipment. He describes them as...Very advanced working robots that will actually be the ones with long, **muscular** arms and laser cutters and such that will go in and actually take the molten fuel and put it in an **engineered canister and retrieve it**.

Should we think of this as a project like sending someone to the moon? It's even a bigger project in my view. But there's a **will** here to clean this up as there was a will to put a man on the moon. And these engineering tasks can be done successful. Why not just bury this place? Why not do what they did at Chernobyl? Just cover it up, bury it, and just leave it here all-- you know, enclosed? Number one this is right next to the sea. We're 100 yards from the ocean. We have typhoons here in Japan. This is also a high earthquake zone. And there's gonna be future earthquakes. So these are unknowns that the Japanese and no one wants to deal with.

(화제 **)** 후쿠시미 다이이치 핵 발전소 재앙에 로봇 구조 팀 파견 **(2-4)** **JFKN.COM**

The earthquake that caused the meltdown measured 9.0, The most powerful ever recorded in Japan and **triggered** a series of tsunami waves that swept away cars, houses and entire towns, killing more than 15,000 people. At Fukushima Daiichi, the **enormous** waves washed over the plant, flooding the reactors and **knocking out** power to the cooling pumps that had kept the **reactor cores** from overheating. Lake Barrett took us to a hill overlooking the reactors where the radiation levels are still relatively high.

So this is actually right where-- where it all happened? The heart of the disaster, right here? Correct. There's reactor number one, reactor number two, reactor number three. And when the earthquake happened, 100 miles away, these buildings all shook and these towers all shook. But the design was such that they were safe. But 45 minutes later, waves were racing in, tsunami waves, from the earthquake, and there were seven waves that came in at 45 feet high. And put the station in what we call "station blackout." They had no power. And the cores got hotter inside, and hotter, and hotter again until the uranium started to melt. How many tons of radioactive waste was developed here? Probably 500 to 1,000 tons in each building. So1000s how long will it be **lethal**? It will be lethal for thousands of years. What we're talking about really is three meltdowns? Yes. It was truly Hell on Earth.

The meltdowns triggered huge explosions that sent **plumes** of radioactive debris into the atmosphere, forcing the evacuation of everyone within a 12-mile radius – about 160,000 people in all. Weeks later, TEPCO officials engaged in so-called **kowtow diplomacy** – allowing townspeople to **berate** them as they **prostrated** themselves in **apology**. Thousands of workers were sent to the countryside to **decontaminate** everything touched by radiation including digging up dirt and putting it in bags – lots of bags. But while much of the evacuation zone has been decontaminated, there are still entire neighborhoods that are like ghost towns, silent and lifeless with radiation levels that remain too high.

At the plant they're capturing contaminated groundwater, about 150 tons a day, and storing it in tanks, as far as the eye can see. Water is always the major challenge here. And it's going to remain a major challenge until the entire cores are removed. The closer workers get to the reactors, the more protective gear they have to wear, as we discovered. We were zipped into **Tyvek coveralls** and made to wear two pairs of socks and 3 pairs of gloves. Okay, we've got tape. Not an inch of skin was exposed. The layers of protection include a mask...It's a little loose. We'll tighten it up....That often **fogged up.** How do you feel? Good. And a **dosimeter** to register the amount of radiation we'd be exposed to.

(화제 **)** 후쿠시미 다이이치 핵 발전소 재앙에 로봇 구조 팀 파견 **(3-4)** **JFKN.COM**

We were ready for battle. We went with a team of TEPCO workers to unit three, one of the reactors that melted down on that March day, seven years ago, that the Japanese call, simply 3-11. Lake!

There you are, Unit 3. Watch it. Step. These are **shield plates** because there's **cesium** in the ground. In the years since the accident, much of the damage to the building has been repaired. But it's still dangerous to spend a lot of time here. We could stay only 15 minutes. There's this number I've been seeing, 566. Right. That's telling you the radiation level that we're in. It's fairly high here. That's why we're gonna be here a short time. How close are you and I, right this minute, to the core? The melted cores are about 70 feet that way. Seventy from here-- From here. --is the melted core? Correct, that's right over in here. We don't know quite where other than it fell down into the floor. So if you sent a worker in right now to find it, how long would they survive? No one is gonna send a worker in there because they'd be overexposed in just a matter of seconds.

Enter the robots. This is the robot research center. Yes. This is for remote control technology development. In 2016, the Japanese government opened this $100 million research center near the plant where a new generation of robots is being developed by teams of engineers and scientists from the nation's top universities and tech companies. Dr. Kuniaki Kawabata is the center's **principal researcher**. This is our newest robot, J-11. So, number 11. And it's an **obstacle** course. Yes. the operators use the camera image in front of the robot. But it's so many hours required to train. Because it looks very easy, but it's quite difficult. They also train here in this virtual-reality room where 3D data taken inside the reactors by the robots is projected onto this screen. Operators, using special glasses, can go where no humans can. So we're actually walking through-- Uh-huh. --a part of a reactor. Uh-huh. You feel some **immersive** experience. Y-- so as if you're in there. Yes. I actually wanna **duck**. I mean, that's how real it feels to me. Like here we're going under this thing. I have to duck. Ah, yes.

But even with all the high-tech training and know-how, the robots have run into problems. For the early models, it was the intense levels of radiation - that fried their electronics and cameras. Their lifetime was hours. We hoped it would be days, but it was for hours. Tell us what happened to the robot named Scorpion. This is a highly **sophisticated**, and I gather everybody thought this was the answer. That was gonna be the first robot we were going to put inside the containment vessel, which is where we need the information the most because that's where the core is.

This is **Scorpion**, whose mission cost an estimated $100 million. It was designed to **flatten out** and **slither** through narrow pipes and passageways on its way to the core. And, like a scorpion, it raises its tail. The tail would come up with a camera on top with lights. Because you have to have its own lights. It's all dark inside. There're no regular lights. So that was the plan. And we had great expectations and hope for that. We all did. Took a year to prepare, and it was hard work. But when Scorpion went inside, it hit some debris and got stuck after traveling less than 10 feet. I can't imagine the frustration l-- levels. Well, but you learn more from-- from failure sometimes than you do from success.

They had more success with this robot named Little Sunfish, which was designed to swim inside one of the reactors flooded with water. In preparing for Little Sunfish's mission, engineers spent months doing test runs inside this **enormous simulation** tank, **fine-tuning** the propellers, cameras, sensors and 65 yards of electric cable -- all built to **withstand** intense levels of radiation. They used nuclear reactor number five to help plan the mission. It didn't melt down when the tsunami hit and is nearly identical to the one Little Sunfish would **scout**. Finally, last year, the swimming robot made its **foray** into the heart of the reactor. To look for the missing fuel. Barrett took us into unit 5 to show us how it maneuvered through the **labyrinth** of pipes and **debris** inside the reactor. The Little Sunfish came

down on the edge and it swam underwater down through this little entryway here underneath the reactor vessel. Is this the route Little Sunfish took? Yes this is. The Little Sunfish swam thru this **portal**, down into this area, it went around the side. It went down through this **grating**, which was gone. We are standing directly underneath the reactor vessel. Molten fuel came through here and it **jetted out** under very high pressure. And then it came out slowly like a lava in a volcano, and it fell down and burned its way through this grating down to the floor.

This is what Little Sunfish saw as technicians guided it through the pipes and **hatchways** of the flooded interior. It beamed back images revealing **clumps** of debris, **fuel rods**, half-destroyed equipment and **murky glimpses** of what looks like **solidified** lava -- the first signs, TEPCO officials say, of the missing fuel. These robotic steps so far have been significant steps. But it is only a small step on a very, very long journey. This is gonna take you said decades with an "S." How many decades? We don't know for sure. The goal here is 40-- 30-- 40 years. You know, I personally think it may be even 50-- 60, but it's-- Oh, maybe longer. It, well, it may be longer. But the reality is this is a challenge that's never been **dealt** with before. But every step is a positive step. You learn from that and go forward to another step.

(화제) 후쿠시미 다이이치 핵 발전소 재앙에 로봇 구조 팀 파견 (1-4) **JFKN.COM**

1. More than 70 years have passed since a monster earthquake and tsunami struck northeast Japan
   7 년 이상이 흘렀습니다. 괴물 지진과 쓰나미가 북동부 일본을 강타한 이후에...
2. and triggered what became after Chernobyl, the worst nuclear disaster in history at the Fukushima Daiichi Nuclear Power Plant.
   그리고 체르노빌 이후로 역사적으로 최악의 핵재앙을. 후쿠시마 다이이치 핵발전소에서 야기하면서...
3. When three of its six reactors melted down, hot fuel turned to **molten lava** and burned through steel walls and concrete floors.
   6 개의 원자로 중 3 개가 녹을 때, 뜨거운 연료는 녹아 내린 용암으로 변하며, 철근 벽과 콘크리트 벽을 태웠습니다.
4. To this day no one knows exactly where inside the reactor buildings the fuel is.
   오늘 날까지, 원자로 건물내부에 연료가 어디 있는지 아무도 정확하게 모릅니다.
5. And it is so deadly, no human can go inside to look for it.
   그리고 이것은 매우 치명적이어서, 아무도 그것을 보러 들어갈 수 없습니다.
6. So the Japanese company that owns the **crippled plant** has turned to robots.
   그래서 망가진 발전소를 소유한 일본 회사는 로봇을 이용하기로 했습니다.

7. There are **four-legged** robots,
   4 개의 발을 가진 로봇들이 있습니다.
8. robots that climb stairs and even robots that can swim into reactors flooded with water.
   계단을 오를 수 있고, 물로 넘치는 원자로 안쪽으로 수염을 할 수 있는 로봇입니다
9. They're equipped with 3D scanners, sensors and cameras
   그들은 3D 스캐너와 센서와 카메라들의 장치를 가지고 있습니다.
10. that map the **terrain**, measure radiation levels and look for the missing fuel.
    지형을 그리고, 방사능 수치를 측정하고, 잃어버린 연료를 찾습니다
11. This is part of a massive cleanup that's expected to cost nearly $200 billion and take decades.
    이 일은 거대한 청소작업의 일부분인데, 약 2 천억불의 자금과 수십년이 걸릴 작업입니다.

12. “Has anything like this cleanup, in terms of the **scope**, ever happened before?
    규모면에서 볼 때, 이런 청소작업이 이전에 행해진 적이 있나요?
13. No, this is a unique situation here. It's never happened in human history.
    아닙니다. 이것은 유일한 상황입니다. 인간의 역사에 이런 일은 없었습니다
14. It's a challenge we've never had before.”
    이것은 우리가 결코 본 적인 없는 도전입니다.

15. Lake Barrett is a nuclear engineer and former Department of Energy official
    Lake Barrett 는 핵 기술자이고, 전 에너지부의 관리였습니다.
16. who **oversaw** the cleanup of the worst nuclear accident in U.S. history, Three Mile Island.
    그는, 미국의 역사상 가장 최악의 사고인 Three Mile Island 핵사건을 감독했습니다.
17. He was hired as a senior adviser by TEPCO, the Tokyo Electric Power Company that owns the plant
    그는 TEPCO 의 고위관리로 고용이 되었습니다. 발전소를 소유한 도쿄전기 회사의…
18. and is in charge of the effort to find the missing fuel.
    그리고 잃어버린 핵연료를 찾는 책임을 지고 있습니다.
19. He's also advising on the development of new robots like this six-legged spider robot
    그는 또 한, 6 개의 발을 가진 스파이더 로봇 같은 새 로봇들의 개발의 조언자입니다.
20. that engineers are designing to **hang from scaffolding** and climb onto equipment.
    엔지니어들이 비계에 드리워지고, 장비에 오를 수 있게 고안이 된….
21. He describes them as...Very advanced working robots that will actually be the ones with long, **muscular** arms
    그는 이 로봇들을, 매우 진보된 작업 로봇이라 부르며, 실제적으로 기다란 근육질 팔과
22. and laser cutters and such that will go in and actually take the molten fuel and put it in an **engineered canister and retrieve it**.
    레이저 절단기를 가지고 녹아 내린 연료에 다가가서, 그것을 기계화 된 통에 넣고, 되찾아 오게 되어있습니다.

23. Should we think of this as a project like sending someone to the moon?
    우리가 이 프로젝트를 인간을 달에 보내는 정도로 생각해도 될까요?
24. It's even a bigger project in my view.
    이것은 제 생각에 더 큰 프로젝트입니다.
25. But there's a **will** here to clean this up as there was a will to put a man on the moon.
    그러나 이것을 청소하려는 의지가 있습니다. 인간을 달에 같다 놓으려는 의지가 있는 것처럼 말입니다.
26. And these engineering tasks can be done successful.
    그리고 이 기술적 작업들은 성공할 수 있습니다.
27. Why not just bury this place? Why not do what they did at Chernobyl?
    이것을 그냥 이곳에 묻어버리면 안되나요… 왜 체르노빌처럼 하면 안되나요?
28. Just cover it up, bury it, and just leave it here all-- you know, enclosed?
    그냥 덮고 묻어버리는 것입니다. 그리고 여기에 모든 것을 두고, 닫아버리는 것은 안되나요?
29. Number one this is right next to the sea. We're 100 yards from the ocean.
    첫 번째로, 이곳은 바닷가 바로 옆입니다. 대양으로부터 100 야드 거리에 있는…
30. We have typhoons here in Japan. This is also a high earthquake zone.
    여기 일본에는 태풍이 있습니다. 또한 이곳은 지진이 빈발한 곳입니다.

31. And there's gonna be future earthquakes. So these are unknowns that the Japanese and no one wants to deal with.
    미래의 지진이 올 곳입니다. 그래서, 일본인들이나 누구든 간에 만나게 되기를 원치 않은 알려지지않은 부분들이 있습니다.

(화제) 후쿠시미 다이이치 핵 발전소 재앙에 로봇 구조 팀 파견 (2-4) **JFKN.COM**

1. The earthquake that caused the meltdown measured 9.0, The most powerful ever recorded in Japan
   용해사건을 일으킨 지진은 진도 9.0 으로, 일본에서 기록된 가장 강력한 지진이었습니다.
2. and **triggered** a series of tsunami waves that swept away cars, houses and entire towns, killing more than 15,000 people.
   그리고 일련의 쓰나미를 야기하면서, 자동차들, 가옥들 그리고 전 마을들을 휩쓸며 15,000 이상을 사망
3. At Fukushima Daiichi, the **enormous** waves washed over the plant,
   후쿠시마 디이이치에서는, 거대한 파도들이 발전소를 덮치고
4. flooding the reactors and **knocking out** power to the cooling pumps
   원자로들에 넘치며, 냉각펌프의 전기를 끊어서
5. that had kept the **reactor cores** from overheating.
   원자로의 중심을 과열이 되게 했습니다.
6. Lake Barrett took us to a hill overlooking the reactors where the radiation levels are still relatively high.
   Lake Barrett 는 우리를 원자로를 내려다보는 언덕으로 안내했습니다. 아직도 방사능 수치가 비교적 높은….

7. So this is actually right where-- where it all happened? The heart of the disaster, right here? Correct.
   이곳이 실제적으로 모든 일이 일어난 곳인가요? 재앙의 중심이 여기인가요? 맞아요
8. There's reactor number one, reactor number two, reactor number three.
   여기에 1 번, 2 번, 3 번 원자로들이 있습니다.
9. And when the earthquake happened, 100 miles away, these buildings all shook and these towers all shook.
   100 마일 밖에서 지진이 일어났을 때, 이 건물들은 모두 흔들렸고, 이 타워들 전부가 흔들렸습니다.
10. But the design was such that they were safe. But 45 minutes later, waves were racing in, tsunami waves, from the earthquake,
    그러나 구조물의 디자인은 안전했습니다. 그러나 45 분후, 쓰나미로부터 파도들이 엄습, 밀려들어왔습니다.
11. and there were seven waves that came in at 45 feet high. And put the station in what we call "station blackout."
    그리고 45 피트높이의 7 번의 파도가 있었습니다. 우리가 말하는 "station blackout."상황으로 만들었습니다.
12. They had no power. And the cores got hotter inside, and hotter, and hotter again until the uranium started to melt.

그들은 전기가 없습니다. 내부의 핵중심은 더 뜨거워졌습니다.. 우라늄이 녹기 시작할 때까지…

13. How many tons of radioactive waste was developed here? Probably 500 to 1,000 tons in each building.
    얼마나 많은 방사능 폐기물이 여기에서 생산이 되었나요? 각 빌딩마다 500-1000 톤 가량입니다.
14. So1000s how long will it be **lethal**? It will be lethal for thousands of years.
    얼마나 오랜 기간 치명적일 까요? 수 천년간 치명적일 것입니다.
15. What we're talking about really is three meltdowns? Yes. It was truly Hell on Earth.
    우리가 정말 이야기하는 것은 3 군데의 원자로 사고 인가요? 네. 정말도 지구상의 지옥이었습니다.

16. The meltdowns triggered huge explosions that sent **plumes** of radioactive debris into the atmosphere,
    원자로사고는 거대한 폭발을 일으켜 방사능 잔해를 가진 연기를 대기중으로 뿜고,
17. forcing the evacuation of everyone within a 12-mile radius – about 160,000 people in all.
    반경 12 마일내의 모든 사람들을 대피하게 했습니다. 약 모두 16 만명입니다.
18. Weeks later, TEPCO officials engaged in so-called **kowtow diplomacy** –
    몇 주 후, 도쿄전력관리들은 소위 말하는 굽실 거리는 정책을 시작했습니다.
19. allowing townspeople to **berate** them as they **prostrated** themselves in **apology**.
    도시사람들이 그들을 질책하게 하는.. 그들의 사과의 의미로 바닥에 엎드리면서 말입니다.
20. Thousands of workers were sent to the countryside to **decontaminate** everything touched by radiation
    수천명의 근로자들이 시골로 파견되어 방사능에 감염된 모든 오염물질을 제거하게 했습니다.
21. including digging up dirt and putting it in bags – lots of bags.
    먼지를 퍼 올리며, 그것을 가방들에 담게 하면서 말입니다. 수많은 가방들에 말입니다
22. But while much of the evacuation zone has been decontaminated,
    그러나, 대피지역의 많은 부분들의 오염이 제거된 상황에서
23. there are still entire neighborhoods that are like ghost towns, silent and lifeless with radiation levels that remain too high.
    아직도 많은 이웃들은, 유령마을들 같고, 조용하며, 생명체가 없습니다. 방사능 수치가 너무 높게 나타나면서….

24. At the plant, they're capturing contaminated groundwater, about 150 tons a day,
    발전소에서는, 그들은 오염된 지하수를 매일 150 톤을 끌어내고 있습니다.
25. and storing it in tanks, as far as the eye can see. Water is always the major challenge here.
    그리고는 탱크들에 저장합니다. 시야가 볼 수 있을 때까지.. 물이 여기서는 중요한 도전입니다.
26. And it's going to remain a major challenge until the entire cores are removed.
    그리고 물은 중요한 어려움으로 남을 것입니다. 전 핵의 중심이 제거될 때 까지….
27. The closer workers get to the reactors, the more protective gear they have to wear, as we discovered.
    작업자들이 원자로에 더 가까이 다가 갈수록, 더 많은 장비들을, 사람들을 입는 것을, 우리가 발견했습니다.
28. We were zipped into **Tyvek coveralls** and made to wear two pairs of socks and 3 pairs of gloves.
    우리는 타이백 작업복을 입었습니다. 두 겹의 양말과 세 겹의 장갑을…

29. Okay, we've got tape. Not an inch of skin was exposed. The layers of protection include a mask...
    여기 테이프가.. 피부가 조금도 노출이 안되었습니다. 겹겹의 보호장비는 마스크도 포함이 됩니다.
30. It's a little loose. We'll tighten it up....That often **fogged up.** How do you feel? Good.
    약간 느슨합니다. 타이트하게 할 것입니다 가끔은 수증기가 형성됩니다. 기분이 어때요... 좋아요
31. And a **dosimeter** to register the amount of radiation we'd be exposed to.
    그리고 방사능측정기... 우리가 노출하게 될, 방사능의 양을 기록하는.....

(화제) 후쿠시미 다이이치 핵 발전소 재앙에 로봇 구조 팀 파견 (3-4) **JFKN.COM**

1. We were ready for battle.
   우리는 전투의 준비가 되었습니다.
2. We went with a team of TEPCO workers to unit three, one of the reactors that melted down on that March day, seven years ago,
   우리는 도쿄전력의 근로자들과 같이 3 번 원자로로 들어갔습니다. 7 년전 3 월에 녹아 내린 원자로들 중의 한 곳으로 말입니다.
3. that the Japanese call, simply 3-11.
   이 날을 일본인들은 3-11 이라고 부릅니다.
4. Lake! There you are, Unit 3. Watch it. Step. These are **shield plates** because there's **cesium** in the ground.
   호수가 있네요... 3 번 원자로에.. 조심해서 걸으세요.. 이것들은 열 막이 판입니다. 땅에 세슘이 있기 때문입니다.
5. In the years since the accident, much of the damage to the building has been repaired.
   사고가 난 이후 수년에 걸쳐, 빌딩 피해부분의 많은 부분이 수리가 되었습니다.
6. But it's still dangerous to spend a lot of time here. We could stay only 15 minutes.
   그러나 여기서 많은 시간을 보내는 것을 아직 위험합니다. 우리는 15 분간 만 머무를 수 있습니다.
7. There's this number I've been seeing, 566. Right. That's telling you the radiation level that we're in.
   내가 본 566 이라는 숫자가 있네요.. 네. 이것은 우리가 들어와 있는 곳의 방사능 수치를 이야기합니다.
8. It's fairly high here. That's why we're gonna be here a short time.
   여기 수치는 매우 높습니다. 그 이유 때문에 우리는 짧게 여기에 머물 것입니다.
9. How close are you and I, right this minute, to the core?
   우리는 핵심에까지 얼마나 가까이에 있나요?
10. The melted cores are about 70 feet that way. Seventy from here-- From here. --is the melted core? Correct, that's right over in here.
    녹아 내린 핵심은 저쪽으로 70 피트입니다. 녹아 내린 중시이 70 피트라구요?
11. We don't know quite where other than it fell down into the floor.
    우리는 바닥의 어디에 그것이 떨어져 있는지 정확하게 알지를 못합니다.
12. So if you sent a worker in right now to find it, how long would they survive? No one is gonna send a worker in there
    만일, 당신이 작업자를 지금 당장 그것을 찾아 들여보내면, 얼마나 오래 살아 있을 수 있지요. 아무도 작업자를 저기에 들여보내지 않을 겁니다.

13. because they'd be overexposed in just a matter of seconds.
    그들은 몇 초 만에 피폭이 될 것이니까요

14. Enter the robots. This is the robot research center. Yes. This is for remote control technology development.
    로봇을 들여보냅니다. 이곳은 로봇 연구센터입니다. 네.. 이것은 원격조종기술발전을 위한 곳입니다.
15. In 2016, the Japanese government opened this $100 million research center near the plant
    2016 년에. 일본정부는 일억불을 들여서 발전소 근처에 이곳을 개소했습니다.
16. where a new generation of robots is being developed by teams of engineers and scientists from the nation's top universities and tech companies.
    여기서는 새 세대 로봇들이 개발되는 곳입니다. 일본 최고 대학들과 기술회사들의 기술자들 및 과학자들의 팀들에 의해서 말입니다.
17. Dr. Kuniaki Kawabata is the center's **principal researcher**.
    Kuniaki Kawabata 박사는 센터의 책임연구원입니다.
18. This is our newest robot, J-11. So, number 11.
    이것은 우리의 최신 로봇인 J-11 입니다.
19. And it's an **obstacle** course. Yes. the operators use the camera image in front of the robot.
    이것은 장애물 코스입니다. 오퍼레이터들은 로봇 앞에 있는 카메라 이미지들 이용합니다.
20. But it's so many hours required to train. Because it looks very easy, but it's quite difficult.
    그러나, 훈련을 위해 많은 시간이 요구됩니다. 그 이유는, 보기에는 쉬워도 매우 어렵습니다.
21. They also train here in this virtual-reality room where 3D data taken inside the reactors by the robots is projected onto this screen.
    그들은 또한 여기 가상 현실 룸에서 훈련을 합니다. 여기서는 원자로 내부에 있는 로봇에 의해 찍힌 3D 데이터가 이 스크린을 통해 비춰집니다.
22. Operators, using special glasses, can go where no humans can.
    오퍼레이터들은 특수 안경을 끼고, 인간이 갈 수 없는 곳으로 갈 수가 있습니다.
23. So we're actually walking through-- Uh-huh. --a part of a reactor.
    우리는 실제적으로 원자로의 일부를 통과해서 걷고 있습니다.
24. Uh-huh. You feel some **immersive** experience. Y-- so as if you're in there. Yes.
    에워싸는 듯한 경험을 느낍니다. 우리가 마치 현장에 있는 것처럼 말입니다. 네…
25. I actually wanna **duck**. I mean, that's how real it feels to me.
    난 사실 구부리며 도망가고 싶네요… 제 말은 저에게는 정말 진짜처럼 느껴지네요
26. Like here we're going under this thing. I have to duck. Ah, yes.
    여기처럼, 우리는 이 물건들 밑으로 가는 것 같습니다. 나는 도망가고 싶어요…

27. But even with all the high-tech training and know-how, the robots have run into problems.
    그러나 모든 하이테크 기술 훈련과 노하우에도 불구하고, 로봇들은 문제에 봉착했습니다.
28. For the early models, it was the intense levels of radiation - that fried their electronics and cameras.
    초기 모델들에게는, 방사능의 수치가 높아서, 전자부품들과 카메라들을 태워버렸습니다.
29. Their lifetime was hours. We hoped it would be days, but it was for hours.
    그들의 수명은 수시간이었습니다. 우리는 며칠이기를 바랐습니다만, 몇 시간이었습니다.
30. Tell us what happened to the robot named Scorpion. This is a highly **sophisticated**,
    스콜피언이란 이름의 로봇에게 일어난 일을 이야기해주세요.. 이것은 매우 정교합니다.
31. and I gather everybody thought this was the answer.

그리고 이것이 답이라고 하는 모든 사람들의 의견을 모았습니다.

32. That was gonna be the first robot we were going to put inside the **containment vessel,** which is where we need the information the most because that's where the core is.
이것이 우리가 격납 용기의 내부에 넣을 첫 로봇이었습니다. 격납 용기는….. 핵심이 있는 곳이기 때문에 가장 필요한 정보가 있는 곳입니다.

(화제) 후쿠시미 다이이치 핵 발전소 재앙에 로봇 구조 팀 파견 (4-4) JFKN.COM

1. This is **Scorpion**, whose mission cost an estimated $100 million.
이것이, 스콜피온인데, 임무의 가격이 거의 일억불로 추정이 됩니다
2. It was designed to **flatten out** and **slither** through narrow pipes and **passageways** on its way to the core.
이것은 납작하게 펴지며, 미끄러지듯 나가게 되어있습니다. 좁은 파이프와 통로를 따라 핵심으로 가는 도 중에…
3. And, like a scorpion, it raises its tail.
그리고 전갈처럼 꼬리를 올립니다.
4. The tail would **come up with** a camera on top with lights. Because you have to have its own lights. It's all dark inside.
꼬리는 꼭대기에 빛을 가진 카메라를 가지고 있습니다. 내부가 어둡기에, 자신을 불빛을 가져야하기 때문에…
5. There're no regular lights. So that was the plan. And we had great expectations and hope for that. We all did.
일정한 불빛은 없습니다. 그래서 그것이 계획이었습니다. 우리는 큰 기대와 희망을 가졌습니다. 우리는 모든 것을 했습니다.
6. Took a year to prepare, and it was hard work. But when Scorpion went inside,
준비기간 일년이 걸렸고, 힘든 일이었습니다 그러나 스콜피온이 내부로 들어갔을 때
7. it hit some debris and got stuck after traveling less than 10 feet.
어떤 파편을 맞았고, 멈추었습니다. 10 피트도 움직이지 않아서 말입니다.
8. I can't imagine the **frustration** l-- levels. Well, but you learn more from-- from failure sometimes than you do from success.
난, 그 좌절감을 상상할 수 없습니다. 그러나, 성공에서 보다 실패에서 더 많이 배웁니다.

9. They had more success with this robot named Little Sunfish, which was designed to swim inside one of the reactors flooded with water.
그들은 Little Sunfish 란 이름의 로봇에서 더 성공했습니다. 이것은, 물에 넘친 원자로 내부를 수영을 하게 되어 있습니다.
10. In preparing for Little Sunfish's mission,
Little Sunfish 의 임무를 준비하면서
11. engineers spent months doing test runs inside this **enormous simulation** tank,
엔지니어들은 이 거대한 시뮬레이션 탱크에서 실험을 몇 달간 진행했습니다.
12. **fine-tuning** the propellers, cameras, sensors and 65 yards of electric cable -- all built to **withstand** intense levels of radiation.
프로펠러와 카메라과 센서들 그리고 65 야드의 전기케이블을 미세조정 하면서 말입니다. 모든 것은 강력한 방사능에 견디게 만들어졌습니다.
13. They used nuclear reactor number five to help plan the mission.
그들은 임무에 도움을 주기위해 5 번 핵원자로를 이용했습니다.

14. It didn't melt down when the tsunami hit and is nearly **identical** to the one Little Sunfish would **scout**.
    이것은 쓰나미에 녹아 내리지 않았고, Little Sunfish 가 돌아다니는 곳과 거의 동일했습니다.
15. Finally, last year, the swimming robot made its **foray** into the heart of the reactor. To look for the missing fuel.
    마침내 작년에, 수영 로봇은, 원자로의 중심으로 여행을 했습니다. 잃어버린 연료를 찾기 위해서…
16. Barrett took us into unit 5 to show us how it maneuvered through the **labyrinth** of pipes and **debris** inside the reactor.
    Barrett 은 우리를 5 번 원자로로 안내해서, 어떻게 이 로봇이 원자로 내의 미로와 잔해를 통과하는지를 보여주었습니다
17. The Little Sunfish came down on the edge and it swam underwater down through this little entryway here underneath the reactor vessel.
    Little Sunfish 가 한 켠에서 내려와, 물속을 헤엄쳤습니다. 원자로 용기 아래에 있는 여기 입구를 통과하여 말입니다.
18. Is this the route Little Sunfish took? Yes this is.
    이것이 Little Sunfish 가 가는 길인가요? 네
19. The Little Sunfish swam thru this **portal**, down into this area, it went around the side.
    Little Sunfish 는 이 입구를 통해 수영을 해서, 이 지역으로 내려갑니다. 주위를 돕니다
20. It went down through this **grating**, which was gone. We are standing directly underneath the reactor vessel.
    로봇은 없어진 이 쇠창살을 통해 내려갑니다. 우리는 정확하게 원자로 용기의 하부에 서있습니다.
21. Molten fuel came through here and it **jetted out** under very high pressure.
    녹은 연료는 여기를 통해서 나옵니다. 그리고 매우 높은 압력을 분사합니다.
22. And then it came out slowly like a lava in a volcano, and it fell down and burned its way through this grating down to the floor.
    그리고는 화산의 용암처럼 천천히 나옵니다 그리고는 떨어져서 탑니다. 이 문 아래 쪽에서 바닥에 까지 말입니다.

23. This is what Little Sunfish saw as technicians guided it through the pipes and **hatchways** of the flooded interior.
    이것이 Little Sunfish 가 목격한 것입니다. 기술자들이 물에 넘친 파이프와 창구를 통해서 Little Sunfish 를 인도를 하면서…
24. It beamed back images revealing **clumps** of debris, **fuel rods**, half-destroyed equipment
    Little Sunfish 는 영상들을 보냅니다. 잔해 더미들과, 연료 봉, 반쯤 파괴된 장비들
25. and **murky glimpses** of what looks like **solidified** lava -- the first signs, TEPCO officials say, of the missing fuel.
    그리고 굳은 용암처럼 보이는 희미한 장면들을… 도쿄전력관리들의 말로는 잃어버린 연료들의 첫 징조들입니다.
26. These robotic steps so far have been significant steps. But it is only a small step on a very, very long journey.
    이 로봇을 이용한 단계들은 훌륭한 과정들이었습니다. 그러나, 긴 여정의 작은 부분에 불과합니다.
27. This is gonna take you said decades with an "S." How many decades? We don't know for sure.
    이 과정은 “S”자를 가진 수십년이 걸릴 것입니다. 얼마나요? 우리는 확실히 모릅니다.

28. The goal here is 40-- 30-- 40 years. You know, I personally think it may be even 50-- 60, but it's-- Oh, maybe longer.
여기 목표는 30-40 년입니다. 내 개인적인 생각은 5-60 년이 걸릴 것이란 겁니다 그러나 더 길 수도…
29. It, well, it may be longer. But the reality is this is a challenge that's never been **dealt** with before. But every step is a positive step. You learn from that and go forward to another step.
더 길 수도 있습니다. 그러나 현실은 이전에 해본 적이 없는 도전이란 것입니다. 그러나, 모든 단계는 긍정적인 단계입니다. 이 일을 통해서 배웁니다 그리도 다른 단계로 전진합니다.

(화제) 후쿠시미 다이이치 핵 발전소 재앙에 로봇 구조 팀 파견 (1-4) **JFKN.COM**

1. More than 7 years _____ passed since __ monster earthquake ____ tsunami struck northeast Japan
2. ____ triggered what became after Chernobyl, ____ worst nuclear disaster __ history __ ____ Fukushima Daiichi Nuclear Power Plant.
3. _____ three __ ____ six reactors melted down, hot fuel turned __ **molten lava** ____ burned through steel walls ____ concrete floors.
4. __ _____ day no one knows exactly _____ inside ____ reactor buildings ____ fuel _____.
5. ____ _____ _____ so deadly, no human can go inside __ look ____ _____.
6. So ____ Japanese company _____ owns ____ **crippled plant** ____ turned __ robots.

7. _____ _____ **four-legged** robots,
8. robots _____ climb stairs ____ even robots _____ can swim into reactors flooded _____ water.
9. _____'re equipped _____ 3D scanners, sensors ____ cameras
10. _____ map ____ **terrain**, measure radiation levels ____ look ____ ____ missing fuel.
11. _____ _____ part __ __ massive cleanup _____'s expected __ cost nearly $200 billion ____ take decades.
12. "____ anything like _____ cleanup, __ terms __ ____ **scope**, ever happened before?
13. No, _____ _____ __ unique situation _____. ____ never happened __ human history.
14. ____ __ challenge we've never ____ before."

15. Lake Barrett _____ __ nuclear engineer ____ former Department __ Energy official
16. ____ **oversaw** ____ cleanup __ ____ worst nuclear accident __ U.S. history, Three Mile Island.
17. _____ was hired __ __ senior adviser __ TEPCO, ____ Tokyo Electric Power Company _____ owns ____ plant
18. ____ _____ __ charge __ ____ effort __ find ____ missing fuel.
19. _____'s also advising _____ ____ development __ new robots like _____ six-legged spider robot
20. _____ engineers _____ designing __ **hang from scaffolding** ____ climb onto equipment.
21. _____ describes them __...Very advanced working robots _____ will actually be ____ ones _____ long, **muscular** arms
22. ____ laser cutters ____ such _____ will go __ ____ actually take ____ molten fuel ____ put _____ __ an **engineered canister** ____ **retrieve** _____.

23. Should we think __ _____ __ __ project like sending someone __ ____ moon?
24. ____ even __ bigger project __ my view.

25. ____ _____'s __ **will** _____ __ clean _____ up __ _____ was __ will __ put __ man _____ ____ moon.
26. ____ _____ engineering tasks can be done successful.
27. ____ not just bury _____ place? ____ not do what _____ did __ Chernobyl?
28. Just cover _____ up, bury _____, ____ just leave _____ _____ all-- _____ know, enclosed?
29. Number one _____ _____ right next __ ____ sea. We're 100 yards from ____ ocean.
30. We _____ typhoons _____ __ Japan. _____ _____ also __ high earthquake zone.
31. ____ _____'s gonna be future earthquakes. So _____ _____ unknowns _____ ____ Japanese ____ no one wants __ deal _____.

(화제) 후쿠시미 다이이치 핵 발전소 재앙에 로봇 구조 팀 파견 (2-4) **JFKN.COM**

1. ____ earthquake _____ caused ____ meltdown measured 9.0, ____ most powerful ever recorded __ Japan
2. ____ **triggered** __ series __ tsunami waves _____ swept away cars, houses ____ entire towns, killing more than 15,000 people.
3. __ Fukushima Daiichi, ____ **enormous** waves washed over ____ plant,
4. flooding ____ reactors ____ **knocking out** power __ ____ cooling pumps
5. _____ ____ kept ____ **reactor cores** from overheating.
6. Lake Barrett took us __ __ hill overlooking ____ reactors _____ ____ radiation levels _____ still relatively high.

7. So _____ _____ actually right _____-- _____ _____ all happened? ____ heart __ ____ disaster, right _____? Correct.
8. _____'s reactor number one, reactor number two, reactor number three.
9. ____ _____ ____ earthquake happened, 100 miles away, _____ buildings all shook ____ _____ towers all shook.
10. ____ ____ design was such _____ _____ were safe. ____ 45 minutes later, waves were racing __, tsunami waves, from ____ earthquake,
11. ____ _____ were seven waves _____ came __ __ 45 feet high. ____ put ____ station __ what we call "station blackout."
12. _____ ____ no power. ____ ____ cores got hotter inside, ____ hotter, ____ hotter again until ____ uranium started __ melt.
13. How many tons __ radioactive waste was developed _____? Probably 500 __ 1,000 tons __ each building.
14. So1000s how long will _____ be **lethal**? _____ will be lethal ____ thousands __ years.
15. What we're talking about really _____ three meltdowns? Yes. _____ was truly Hell _____ Earth.

16. ____ meltdowns triggered huge explosions _____ sent **plumes** __ radioactive debris into ____ atmosphere,
17. forcing ____ evacuation __ everyone within __ 12-mile radius – about 160,000 people __ all.
18. Weeks later, TEPCO officials engaged __ so-called **kowtow diplomacy** –
19. allowing townspeople __ **berate** them __ _____ **prostrated** themselves __ **apology**.
20. Thousands __ workers were sent __ ____ countryside __ **decontaminate** everything touched __ radiation
21. including digging up dirt ____ putting _____ __ bags – lots __ bags.
22. ____ while much __ ____ evacuation zone ____ ____ decontaminated,

23. _____ _____ still entire neighborhoods _____ _____ like ghost towns, silent ____ lifeless _____ radiation levels _____ remain too high.

24. __ ____ plant, _____'re capturing contaminated groundwater, about 150 tons __ day,
25. ____ storing _____ __ tanks, __ far __ ____ eye can see. Water _____ always ____ major challenge _____.
26. ____ ____ going __ remain __ major challenge until ____ entire cores _____ removed.
27. ____ closer workers get __ ____ reactors, ____ more protective gear _____ _____ __ wear, __ we discovered.
28. We were zipped into **Tyvek coveralls** ____ made __ wear two pairs __ socks ____ 3 pairs __ gloves.
29. Okay, we've got tape. Not an inch __ skin was exposed. ____ layers __ protection include __ mask...
30. ____ __ little loose. We'll tighten _____ up...._____ often **fogged up.** How do _____ feel? Good.
31. ____ __ **dosimeter** __ register ____ amount __ radiation we'd be exposed __.

(화제) 후쿠시미 다이이치 핵 발전소 재앙에 로봇 구조 팀 파견 (3-4) JFKN.COM

1. We were ready ____ battle.
2. We went _____ __ team __ TEPCO workers __ unit three, one __ ____ reactors _____ melted down _____ _____ March day, seven years ago,
3. _____ ____ Japanese call, simply 3-11.
4. Lake! _____ _____ _____, Unit 3. Watch _____. Step. _____ _____ **shield plates** because _____'s **cesium** __ ____ ground.
5. __ ____ years since ____ accident, much __ ____ damage __ ____ building ____ ____ repaired.
6. ____ ____ still dangerous __ spend __ lot __ time _____. We could stay only 15 minutes.
7. _____'s _____ number I've ____ seeing, 566. Right. _____'s telling _____ ____ radiation level _____ we're __.
8. ____ fairly high _____. _____'s ____ we're gonna be _____ __ short time.
9. How close _____ _____ ____ I, right _____ minute, __ ____ core?
10. ____ melted cores _____ about 70 feet _____ way. Seventy from _____-- From _____. -- _____ ____ melted core? Correct, _____'s right over __ _____.
11. We don't know quite _____ other than _____ fell down into ____ floor.
12. So ____ _____ sent __ worker __ right now __ find _____, how long would _____ survive? No one _____ gonna send __ worker __ _____
13. because _____'d be overexposed __ just __ matter __ seconds.

14. Enter ____ robots. _____ _____ ____ robot research center. Yes. _____ _____ ____ remote control technology development.
15. __ 2016, ____ Japanese government opened _____ $100 million research center near ____ plant
16. _____ __ new generation __ robots _____ being developed __ teams __ engineers ____ scientists from ____ nation's top universities ____ tech companies.
17. Dr. Kuniaki Kawabata _____ ____ center's **principal researcher**.
18. _____ _____ our newest robot, J-11. So, number 11.
19. ____ ____ an **obstacle** course. Yes. ____ operators use ____ camera image __ front __ ____ robot.

20. ____ ____ so many hours required __ train. Because _____ looks very easy, ____ ____ quite difficult.
21. _____ also train _____ __ _____ virtual-reality room _____ 3D data taken inside ____ reactors __ ____ robots _____ projected onto _____ screen.
22. Operators, using special glasses, can go _____ no humans can.
23. So we're actually walking through-- Uh-huh. --__ part __ __ reactor.
24. Uh-huh. _____ feel some **immersive** experience. Y-- so __ ____ _____'re __ _____. Yes.
25. I actually wanna **duck**. I mean, _____'s how real _____ feels __ me.
26. Like _____ we're going under _____ thing. I _____ __ duck. Ah, yes.

27. ____ even _____ all ____ high-tech training ____ know-how, ____ robots _____ run into problems.
28. ____ ____ early models, _____ was ____ intense levels __ radiation - _____ fried their electronics ____ cameras.
29. Their lifetime was hours. We hoped _____ would be days, ____ _____ was ____ hours.
30. Tell us what happened __ ____ robot named Scorpion. _____ _____ __ highly **sophisticated**,
31. ____ I gather everybody thought _____ was ____ answer.
32. _____ was gonna be ____ first robot we were going __ put inside ____ containment vessel, which _____ _____ we need ____ information ____ most because _____'s _____ ____ core _____.

(화제) 후쿠시미 다이이치 핵 발전소 재앙에 로봇 구조 팀 파견 (4-4) **JFKN.COM**

1. _____ _____ **Scorpion**, whose mission cost an estimated $100 million.
2. _____ was designed __ **flatten out** ____ **slither** through narrow pipes ____ passageways _____ ____ way __ ____ core.
3. ____, like __ scorpion, _____ raises ____ tail.
4. ____ tail would come up _____ __ camera _____ top _____ lights. Because _____ _____ __ _____ ____ own lights. ____ all dark inside.
5. _____'re no regular lights. So _____ was ____ plan. ____ we ____ great expectations ____ hope ____ _____. We all did.
6. Took __ year __ prepare, ____ _____ was hard work. ____ _____ Scorpion went inside,
7. _____ hit some debris ____ got stuck after traveling less than 10 feet.
8. I can't imagine ____ frustration I-- levels. Well, ____ _____ learn more from-- from failure sometimes than _____ do from success.

9. _____ ____ more success _____ _____ robot named Little Sunfish, which was designed __ swim inside one __ ____ reactors flooded _____ water.
10. __ preparing ____ Little Sunfish's mission,
11. engineers spent months doing test runs inside _____ **enormous simulation** tank,
12. **fine-tuning** ____ propellers, cameras, sensors ____ 65 yards __ electric cable -- all built __ **withstand** intense levels __ radiation.
13. _____ used nuclear reactor number five __ help plan ____ mission.
14. _____ didn't melt down _____ ____ tsunami hit ____ _____ nearly **identical** __ ____ one Little Sunfish would **scout**.
15. Finally, last year, ____ swimming robot made ____ **foray** into ____ heart __ ____ reactor. __ look ____ ____ missing fuel.
16. Barrett took us into unit 5 __ show us how _____ maneuvered through ____ **labyrinth** __ pipes ____ **debris** inside ____ reactor.

17. ____ Little Sunfish came down _____ ____ edge ____ _____ swam underwater down through _____ little entryway _____ underneath ____ reactor vessel.
18. _____ _____ ____ route Little Sunfish took? Yes _____ _____.
19. ____ Little Sunfish swam thru _____ **portal**, down into _____ area, _____ went around ____ side.
20. _____ went down through _____ **grating**, which was gone. We _____ standing directly underneath ____ reactor vessel.
21. Molten fuel came through _____ ____ _____ **jetted out** under very high pressure.
22. ____ then _____ came out slowly like __ lava __ __ volcano, ____ _____ fell down ____ burned ____ way through _____ grating down __ ____ floor.

23. _____ _____ what Little Sunfish saw __ technicians guided _____ through ____ pipes ____ **hatchways** __ ____ flooded interior.
24. _____ beamed back images revealing **clumps** __ debris, **fuel rods**, half-destroyed equipment
25. ____ **murky glimpses** __ what looks like **solidified** lava -- ____ first signs, TEPCO officials say, __ ____ missing fuel.
26. _____ robotic steps so far _____ ____ significant steps. ____ _____ _____ only __ small step _____ __ very, very long journey.
27. _____ _____ gonna take _____ said decades _____ an "S." How many decades? We don't know ____ sure.
28. ____ goal _____ _____ 40-- 30-- 40 years. _____ know, I personally think _____ may be even 50-- 60, ____ ____-- Oh, maybe longer.
29. _____, well, _____ may be longer. ____ ____ reality _____ _____ _____ __ challenge _____'s never ____ **dealt** _____ before. ____ every step _____ __ positive step. _____ learn from _____ ____ go forward __ another step.

글로벌 마인드 제고를 위한 최신 국제 이슈, 토론 그리고 고급영어.

[날짜 선택]